J. Nelson Spaeth

JOURNAL *of* FORESTRY

November
1931

Vol. XXIX Number 7

Published by the
SOCIETY of AMERICAN FORESTERS

Single Copy Sixty Five Cents Four Dollars per Year

NNUAL MEETING NEW ORLEANS, LA.
DECEMBER 29-30-31, 1931

JOURNAL of FORESTRY

OFFICIAL ORGAN OF THE SOCIETY OF AMERICAN FORESTERS

A professional journal devoted to all branches of forestry

Entered as second-class matter at the post-office at Washington, D. C.

Acceptance for mailing at special rate of postage provided for in the Act of February 28, 1925, embodied in paragraph 4, Section 412, P. L. and R. authorized November 10, 1927.

Office of Publication, Room 810, Hill Bldg., 839 17th St., N. W., Washington, D. C.

Editorial Office, 231 Giannini Hall, Berkeley, California—Manuscripts intended for publication should be sent to Emanuel Fritz, Editor-in-Chief, at this address, or to any member of the Editorial Staff.

The JOURNAL appears eight times a year monthly—with the exception of June, July, August, and September.

The pages of the JOURNAL are open to members and non-members of the Society.

Missing numbers will be replaced without charge, provided claim is made within thirty days after date of the following issue.

Subscriptions, advertising, and other business matters should be sent to the JOURNAL OF FORESTRY, Room 810, Hill Bldg., 839 17th St., N. W., Washington, D. C.

CONTENTS

PAGE

Editorial: Forestry for Country Gentlemen and Foresters 999

Control Work against Bark Beetles in Western Forests and an Appraisal of its Results 1001
F. C. Craighead, J. M. Miller, J. C. Evenden and F. P. Keen

Transportation Planning to Meet Hour-Control Requirements 1019
T. W. Norcross and R. F. Grefe

Forest Fire Damage Appraisal 1034
E. H. MacDaniels

A Bad Fire—A Good Salvage Job 1042
Russell S. Bacon

The Forest Survey in the Bottomland Hardwoods of the Mississippi Delta 1046
G. H. Lentz

A National Forest as a Local Economic Factor 1060
L. L. Bishop

Forestry and Lumbering in British Columbia 1067
P. Z. Caverhill

Briefer Articles and Notes 1075

Reviews 1091

Correspondence 1107

Society Affairs 1109

Society Officers 1123

JOURNAL OF FORESTRY

Vol. XXIX NOVEMBER, 1931 No. 7

The Society is not responsible, as a body, for the facts and opinions advanced in the papers published by it.

EDITORIAL

Forestry for Country Gentlemen and Foresters

FORESTRY, when commercial timber is the objective, and when engaged in privately, should be considered a business. At the same time it lends itself, like the business of farming, to the needs of a man who wants a "side-line" or a hobby. The hobby forest no less than the commercial forest should be a valuable means for advancing the technique of forest handling and the understanding of timber economics.

Many American business men of small and large means have taken up farming as a hobby. The small man contents himself with a suburban property of limited area for floriculture, poultry husbandry, or other specialty, and spends much of his spare time actually working on it, expecting at least to break even financially. His wealthier kindred spirit indulges in large "estates," stock farms or dairy herds and lavishes money for improvements and expert help to develop what is popularly known as a "model farm." Each class risks its money and effort primarily for the pleasure and recreation to be derived from the hobby, and when profit is not a consideration the farm is regarded pretty much the same as a racing stable or a gallery of *objets d'art.* There is a pleasurable thrill in watching things grow, especially when it can be said that they grow better by virtue of one's own initiative, planning, and care.

Adjoining the so-called model or hobby farms, oftentimes, are pieces of woodland or forest, part and parcel of the same property ownership. The owners prize them as they do their farms, and as a rule hold them inviolable from the axe. Yet a paradox exists. The farms receive every bit of attention and the owners do make efforts to sell their surplus and hope even to make a profit. But in the woodlands and forests they do little else but keep out poachers and fire. No one is employed to develop them and the idea of making their management yield pleasure as a hobby, and possibly profit, is hardly considered. A forest property lends itself particularly well to development just for the pleasure of it. It is more cheaply converted into a show property than a farm, though both model farm and hobby forest take considerable time to

show results, and there is always the possibility of so greatly enhancing the value of the timber growth and incidental resources as to make its management pay its cost. Certainly, should a time come when the owner meets with financial reverses and must cease his silvicultural operations, the developed hobby forest would not deteriorate as would a neglected model farm.

We do have some outstanding examples of private forest management for the interest and pleasure that the work offers, but the instances are all too rare. The opportunities for doing more appear to be great. Wooded areas on large estates, game preserves, private and semi-public parks, if left alone indeed improve under only Nature's care but they are too likely to meet the fate of the timber on some of the older English estates, which, for lack of silviculture in the past were found, when sold during and after the war, to have become uniformly overmature, to some extent decadent, and usually of low yield. Under management such growth can be kept healthy and thrifty-looking and made to yield valuable products continuously without imperiling their æsthetic or recreational values, and there is the added pleasure of the work and the satisfaction of doing a worth while thing especially well.

Paradoxical also is the fact that lumbermen and foresters should become infected with the urge to practice farming as a hobby in preference to trying out forestry. Several lumbermen own huge model farms; not a small number of foresters are developing orchards and small farms. As far as known, no lumberman is practicing forestry under the patronage of a hobby, and only a mere handful of foresters has similarly taken a fling at forestry. Model farms are expensive. Model forests would be expensive toys also. But just as hobby farms have proved of incalculable benefit in advancing commercial agriculture and stock raising, so hobby woodlots or forests should show their worth as proving grounds for commercial silvicultural practices and the economics of forestry. Perhaps a lumberman would learn from his hobby forest tract that there is something to lumbering besides harvesting the crop and that some of his experimental work might have applications to his commercial timber. Perhaps the forester owning a small tract for hobby forestry would learn that forestry is better studied in the woods than from books and that forestry, like farming, has its business aspects. Certainly the actual experience of "playing" with a small tract would temper his commercial forestry attitudes.

The possibility of interesting private estate owners in forestry has not been overlooked by consulting foresters but one wonders why they have made so little headway in this field. Perhaps some high-grade extension work is needed to pave the way for them, at any rate this is a suggestion to our extension foresters, who are growing in experience as well as in numbers, to consider the possibilities. It is a suggestion also for foresters to acquire small tracts of woodland instead of farms for trying out forestry to see how it works.

CONTROL WORK AGAINST BARK BEETLES IN WESTERN FORESTS AND AN APPRAISAL OF ITS RESULTS

By F. C. CRAIGHEAD,[1] J. M. MILLER,[2] J. C. EVENDEN,[3] AND F. P. KEEN[4]

United States Bureau of Entomology

Has control work against bark beetles paid? Approximately one million dollars have been expended on a number of control projects. This article is a discussion of the economics of control work and is a candid appraisal of what the money has bought in the way of values saved and of experience gained for guiding future control efforts. With bark beetles still important factors, the recommendations for control policies here offered are particularly timely.

Introduction

EVER SINCE forest protection entered into the program of federal and private owners of our western forest areas, the control of those insects that kill timber by mining the cambium of living trees has been a problem of increasing importance. In the efforts to combat this destructive agency direct measures of artificial control developed by entomologists have, during the past few decades, been applied on a fairly large scale against the more important Dendroctonus beetles, and to a very small extent against species of bark engravers (*Ips* spp.) and flat-headed borers (Buprestidae).

Such methods were untried to begin with, and their effectiveness could be determined only by actual test in the field. The owner of threatened timber was obliged to make his decision between these two courses of action: either to let nature take its course and await developments, hoping that natural factors would check the insects; or to spend money on expensive direct measures of control, without positive assurance that the results would be profitable or lasting. In spite of the uncertainty as to what might be accomplished by employing the methods and plans recommended by entomologists, control campaigns of a fairly comprehensive nature have been undertaken on both federal and private timberlands.

The first control project of which there is a record was initiated on the Black Hills National Forest in South Dakota in 1906, when $2,700 was expended in an effort to check an epidemic of the Black Hills beetle. Since then many projects have been carried out, some of them covering areas of more than 100,000 acres. Up to the present time (1930) approximately $1,000,000 has been expended in the control of bark-beetle infestations, mainly in reserves of timber which are being held until conditions warrant logging and marketing of the lumber.

With this great amount of work as a background, and with the experience that has been acquired, it seems desir-

[1]Principal Entomologist, Washington, D. C.; [2]Senior Entomologist, Berkeley, Calif.; [3]Entomologist, Coeur d'Alene, Ida.; [4]Entomologist, Portland, Ore., Division of Forest Insect Investigations, Bureau of Entomology, U. S. Department of Agriculture.

able to take stock of the results obtained and to decide just how this phase of forest protection has paid off on the investment. Without regard to preliminary theories and expectations as to results, what projects have accomplished an actual saving of timber? Under what conditions has control work succeeded and under what conditions has it failed? Continuation of this activity on the scale now being advocated in national forests, parks, and other holdings should at least be guided by the answers to these questions, based upon an unbiased analysis of results of past work.

Unfortunately, because of limited space, it is impossible to present the facts pertaining to each one of these control projects. Consequently these will be reserved for a later and more comprehensive paper, to be published probably by the U. S. Department of Agriculture. In the present article it will be possible to give only a short abstract of the projects, grouped by bark-beetle species and by tree species or region as the case may be.

Control methods necessarily must be based upon information regarding the seasonal history and habits of the insects, and also, until thoroughly tried out in practice, upon certain conceptions and theories. In the employment of proposed methods it was at first taken for granted that the killing of beetles saved trees. This theory depended largely on the early assumption that when a newly-developed brood of bettles emerge from an infested tree, they attack and kill another tree in the vicinity, so that each succeeding generation kills a fairly regular quota of trees. Therefore, destroying the broods in one infested tree before they emerge saves at least one living tree from attack by the next generation. This conception, if it were the whole truth, would greatly simplify the problem of estimating costs and appraising benefits derived from control work. Obviously on this basis the volume of timber saved would be in direct proportion to the amount of timber treated. However, it was soon realized that so simple an idea of the problem failed to take into account the complex biotic factors which control the abundance of insect populations and govern the rise and fall of bark-beetle epidemics. These even now, after many years' experience in control and investigation, are very little understood.

Other difficulties become obvious when an analysis of the long series of control projects undertaken during the last thirty years is attempted. The following appear to be the most outstanding of these:

1. Lack of accurate data obtained after the completion of the work from the area treated. Some projects have been closely studied by the Bureau of Entomology, but on many others no attempt was made to measure the actual volume of reinfestation that developed after control work was completed.

2. Lack of suitable check areas by which a treated area could be compared with an untreated one. To a great extent this lack of checks is due to natural conditions which can not be remedied. No two areas are ever identical, and seldom even similar in

all their aspects, and it is therefore difficult to reach a conclusion on the results of control work by comparison with check areas.

3. Obscurity of the natural factors influencing the course of the infestation before, during, and after the period of control work. These factors, such as the effects of climatic influences and predators and the distances which beetles fly in reinfesting a control area, may completely outweigh and make it difficult to evaluate the influence of artificial control.

4. Wide variation in objectives, in the control operations that have been undertaken, and in the values, aesthetic or commercial, to be protected. On recreational areas like those in southern California, control work can be considered successful if only a few trees are saved at high cost. In the commercial timber stands of the Northwest, on the other hand, it is frequently the case that a control operation, to be successful, must cause the permanent saving for the sawmill of a quantity of potential lumber worth more than the amount of money spent in killing the beetles. Therefore considerations not purely entomological often enter into the appraisal of results on certain projects.

Another phase of the results from control which has received very little consideration up to the present time has to do with the indirect benefits of the forest. These are seldom tangible and are very difficult to estimate. Perhaps the most important is the reduction of fire hazard within the control area through the removal of trees which would otherwise stand as snags to start lightning fires and to spread burning embers when fires occur. Forests which have been swept by bark-beetle outbreaks, and in which thousands of dead trees have been left among the surviving live ones, become tremendous fire risks and remain so for years. Control methods which require the felling of infested trees serve to remove many of these dangerous snags from the stand. Projects, therefore, which do not show an actual profit from the viewpoint of the amount of timber saved from beetle attack may in the long run pay through reduction of the fire hazard.

Some forest-protective organizations have maintained yearlong employment for their summer fire-protection force by carrying on insect-control work during the winter period, and consider this good practice, even though the reduction of infestation is not outstanding.

From the considerations just enumerated it is obvious that the entire problem involved in the formulation of a control policy is very complicated and can not be settled by merely laying down a few hard-and-fast rules as to when and where and under what conditions control work is to be recommended. Local conditions and values, and quite often other considerations that are not entomological, must largely determine the plans and strategy for each specific project; and these factors should be taken into account in determining the success or failure of each undertaking.

With all these considerations in mind, it is obvious that any broad conclusions as to the results of past

projects are subject to many reservations. However, at least one outstanding conclusion applies to the entire matter, and may be stated as follows: Each species of bark beetle presents its own special problem and must be dealt with differently from other species as to control methods and strategy, and even the same species may present problems which differ in different regions. The management of control operations must therefore vary according to local conditions within the area to be protected. The treatment of the subject in this paper is therefore by species and region.

The Western Pine Beetle
(*Dendroctonus brevicomis* Lec.)

The western pine beetle is by far the most destructive enemy of western yellow pine over a great part of its range through British Columbia, Montana, Idaho, Washington, Oregon, and California. Everywhere throughout the western yellow pine forests of this area it kills a few trees each year. It is in California and southern Oregon, however, that its depredations are the most serious, and the losses here frequently run into hundreds of millions of board feet annually. Western yellow pine is the only host tree attacked except in the southern limit of its range, where Coulter pine, a tree of small commercial importance, is also affected.

Under endemic conditions this bark beetle shows a decided preference for the slower-growing trees, and confines its attacks to single trees and small groups of seldom more than 4 or 5 trees in the overmature stands on the poorer sites. But when outbreaks become epidemic it shows less discrimination. The groups increase until they may include from 50 to 100 trees each, and extend into the better sites and include faster growing stock. Under any condition the infested trees and groups are distributed more or less evenly over large areas.

Observations on the same area over a period of years indicate that in some cases losses are rather closely correlated with climatic conditions. Periods of drought with a deficiency of soil moisture result in a building up of epidemics. With a return to conditions of normal moisture, tree growth is accelerated and the losses decrease. Sometimes low winter temperatures cause a high mortality in the broods and bring about sudden declines in the losses.

THE WESTERN PINE BEETLE IN THE PACIFIC COAST STATES

Infestation Types

The conditions under which control has been attempted may be roughly grouped in three types. These represent differences not only in natural factors, such as climate, site, and composition. but also in the character of the infestations which develop and in the objectives to be accomplished by control work. These types are therefore considered separately in the analysis of results.

West Slope of the Sierra Nevada and of the Cascade Mountains.—This type is limited to the western

slopes of the Cascade Mountains and the Sierra Nevada and to the Coast Range, where conditions of site are varied and the topography is very rough. Pure stands seldom occur, western yellow pine being found in mixture with white fir, Douglas fir, sugar pine, and incense cedar. Conditions of site and growth as a rule are much more favorable than those of the east-slope, the unfavorable sites occurring locally along the lower fringe of the timber belt. All stands are more or less uneven aged and contain a high percentage of young and thrifty mature trees. Although much of the west-side timber is of good quality, stumpage prices are relatively lower than in the east-side type, because of higher logging costs.

Annual losses due to beetles in this type seldom exceed 1 per cent of the stand, and under maximum epidemic conditions do not exceed more than 2 or 3 per cent annually, except in very local outbreaks. Records indicate that an increasing infestation does not maintain its momentum for more than two or at most three seasons, when at least a temporary decline of losses can be expected. Control work here has been taken up mainly for the protection of stumpage values on small areas, although purely recreational areas have been included on a few projects.

East Slope of the Sierra Nevada and of the Cascade Mountains.—This type includes practically pure stands of western yellow pine growing mainly on volcanic soils east of the Cascade Mountains and the Sierra Nevada. Some mixture of incense cedar, white fir, and sugar pine may occur to a very limited extent. The type forms an almost continuous belt, extending from the Columbia River in Oregon, or even a little farther north in Washington, to the Tahoe National Forest in California. The timber is slow-growing, largely mature and overmature, but of fine merchantable quality and high stumpage value. Conditions are favorable for serious beetle epidemics, especially when long periods of drought result in a slowing-down of tree growth. The more severe epidemics have resulted in an annual loss of as high as 15 per cent of the total stand, and in the killing of 50 per cent or more of the timber within a five-year period, as in the Glass Mountain Unit, Modoc National Forest. On this unit the number of trees killed in a single year may run as high as 1,200 per timbered section, but ordinarily the maximum is from 400 to 800. The losses in volume of timber are subject to wide annual fluctuations, an increase for two or three years being followed by a decline from natural causes. The longest period of increase for which there is a record started in 1923 in southern Oregon and northern California, when the annual volume of infested timber increased for four successive seasons, from 1924 to 1928, inclusive, and then declined 80 per cent from natural causes.

Control work in this region is mainly for the protection of stumpage, which ranges in value from $2.00 to $7.00 per thousand.

Southern California Recreational Areas.—Conditions here involve small, more or less isolated areas, located at the higher elevations above the brush belt, where western yellow pine occurs in mixture with white fir, sugar pine, Jeffrey pine, Coulter pine, and incense cedar. The site is generally poor. Annual losses to about the same extent occur in western yellow pine and Coulter pine and are of about the same character and duration as those in the West Side type described above. As protection is primarily for the maintenance of cover on recreational areas and summer home sites, values can be rated much higher than in commercial forests.

History of Control Work

The first projects to deal with the control of the western pine beetle were undertaken in the winter and spring of 1912 in the Klamath National Forest. Following this initial attempt, numerous other projects involving a total expenditure of approximately $275,000 have been carried out under a great variety of conditions, such as those of increasing and decreasing infestation, and in practically all the types of yellow pine stands. These projects have been conducted in the fall, spring, or summer, and continued from one to four years in the same area; and practically all the known methods of controlling outbreaks, such as felling the trees and burning the bark, the use of trap trees, the solar-heat method, and control through logging, have been tested. The acreage covered, the number of trees and the volume of timber treated, and the costs are given in Table 1.

Conclusions and Recommendations for Control Policy

Admittedly the success of all these projects for western pine beetle control has not been spectacular or outstanding. In many cases the work has shown tangible results, but often these results were not substantial enough to show a profit. Some projects were apparently failures. The data to prove positively either success or failure of certain projects is often inadequate. Indirect benefits of control work, such as the reduction of fire hazard, are usually too intangible to be appraised. With the data at hand any broad conclusions, therefore, must be based upon convictions of entomologists and owners who have had long experience in this work, rather than upon any overwhelming weight of evidence. The predilection of the western pine beetle for slow-growing trees and its apparently quick response to climatic influences must also be taken into consideration. With these limitations in mind it is believed that the following conclusions are considered reasonable by all who have followed and closely analyzed these projects:

1. One season of thorough control work results in a reduction of western pine beetle losses on the treated areas as compared with similar untreated areas.

2. (a). The benefits have been greatest when the natural tendency of the infestation was upward;

(b). Under a declining infestation

there was only a small difference in favor of the treated over the untreated areas.

3. The benefits from control work have been temporary, lasting only one or two seasons, and a return to conditions similar to those on untreated areas can be expected unless work is continued on the same area year after year.

In the face of these results, under what conditions is direct control work to be recommended? Considering both economic and entomological factors, control of the western pine beetle is believed practicable under the following conditions:

1. In parks and on recreational areas with high values, where dying trees are objectionable and should be removed for aesthetic considerations or for those of forest sanitation. Under these conditions control work need not necessarily pay its way on the basis of stumpage values saved from further beetle attack.

2. (a). On small, well-isolated areas, where the timber is of high value and where the entire infestation can be treated in one season;

(b). On large areas, preferably with partial isolation, where the entire infested area can be treated and where it is to be logged within three or four years.

3. In commercial stands, whether isolated or not, where control work can be supplemented by logging and salvaged at a low cost or a small profit. Such work may be combined with selective logging to remove susceptible trees and produce better growth conditions, in order to give permanent protection for long periods.

THE WESTERN PINE BEETLE IN THE NORTHERN ROCKY MOUNTAIN REGION

Although the western pine beetle is not nearly so destructive in the northern Rocky Mountain region as in California and Oregon it is of considerable economic importance in Idaho and Montana and northeastern Washington as an enemy of western yellow pine. Light endemic infestations are always present in these yellow pine forests and there have been a few outbreaks which have resulted in the destruction of rather large volumes of timber. There seems to be a much sharper line of demarcation between endemic and epidemic infestations in this region than farther west. Nevertheless the western pine beetle is decidedly secondary in importance as compared with the mountain pine

TABLE 1

RECORD OF CONTROL WORK ON THE WESTERN PINE BEETLE

Type	Number of projects	Period covered	Total[1] acreage	Number of trees treated	Total Volume M.B.M.	Total Cost
West Slope Yellow Pine	15	1911-1924	750,180	15,103	14,437	$ 59,310.71
East Slope Yellow Pine	7	1912-1929	743,929	46,825	50,990	211,738.95
S. Cal. Areas	2	1922-1928	43,500	509	363	2,666.88
Total	24		1,537.609	62,437	65,790	$273,716.54

[1]Acreages covered on same areas during successive years are totaled, as are the annual costs of maintenance work on the same areas.

beetle. Very frequently such outbreaks are in combination with attacks of the mountain pine beetle, the mountain pine beetle taking the smaller trees and the western pine beetle the older and larger ones. Slow-growing trees and over-mature stands are in abundance, so the fact that the losses are usually light must be due largely to unfavorable climatic conditions for beetle propagation rather than to any lack of suitable host material.

Conclusions and Recommendations for Control Policy

Although the few attempts which have been made to control the western pine beetle in this region seem to have been successful, it is not felt that sufficient experience is available to warrant any definite conclusions. The more broken distribution of the yellow pine type should lend itself rather well to artificial control of this insect.

The Southwestern Pine Beetle (*Dendroctonus barberi* Hopk.) in Arizona and New Mexico

In appearance, habits, and character of attack there is very little to distinguish the southwestern pine beetle from its near relative, the western pine beetle. The chief host tree is western yellow pine. This beetle shows a decided preference for old, over-mature trees, and these are attacked singly or in small groups in very scattered distribution. Several species of *Ips* are often associated with this bark beetle in trees attacked by the overwintering generation. Broods of the Colorado pine beetle (*Dendroctonus approximatus* Dietz) and of the Arizona pine beetle (*D. arizonicus* Hopk.), two species which are largely secondary, may be found in the same trees with the southwestern pine beetle. An outbreak which caused considerable concern occurred on the Prescott National Forest from 1927 to 1928. This infestation, which at its height averaged about 200 trees per section, developed in trees of older age classes which were in competition with a second story of young western yellow pine. Control methods are entirely similar to those employed against the western pine beetle.

History of Control Work

Only one project has been undertaken. An area of 16,000 acres on the Prescott National Forest was covered during the winter and spring seasons of 1928 and 1929. A total of 3,185 trees, with a volume of 413,230 board feet, were treated. Results of the first year's work showed a reduction in losses of 70 per cent, as compared with an increase of 300 per cent on near-by untreated areas. There was a general decline of infestation in the region following the control in 1929, and no futher maintenance work has been attempted.

Conclusions and Recommendations for Control Policy

Because of the similarity of this insect to the western pine beetle, both in its habits and in the results which have been obtained on this one pro-

ject, the same recommendations are suggested for the present.

The Mountain Pine Beetle (*Dendroctonus monticolae* Hopk.)

The mountain pine beetle, perhaps the most destructive of all *Dendroctonus* beetles, is of economic importance throughout the states of Washington, Oregon, California, western Nevada, Idaho, western Montana, northwestern Wyoming, and southwestern Canada. This insect attacks and kills western yellow pine, white pine, lodgepole pine, limber pine, white-bark pine, sugar pine, and sometimes Engelmann spruce when it is in association with infested pine. However, it is in the lodgepole pine and white pine stands of the Northern Rocky Mountain region, eastern Oregon, and eastern Washington, and in the sugar pine of California that the destructive activities of this insect are most important.

THE MOUNTAIN PINE BEETLE IN LODGEPOLE PINE IN THE NORTHERN ROCKY MOUNTAIN REGION AND EAST OF THE CASCADES

Normal or endemic infestations of the mountain pine beetle can be found in practically all mature logepole pine forests. The loss of timber resulting from such infestations is of no economic importance and the trees attacked are usually those which have been weakened by fire, lightning, or other causes. From such apparently harmless endemic infestations, however, destructive epidemics may develop with surprising rapidity. These epidemics may be reasonably short-lived, or they may continue, as is more often the case, for a number of years, destroying tremendous volumes of timber and gradually spreading over enormous areas. A striking example of the destructiveness of such epidemics exists at this time in Idaho and Montana. When we consider the tremendous volume of timber destroyed, the dangerous fire hazards created, and the cost and often the physical impossibility of applying control, the urgent need for the early prevention of outbreaks of the mountain pine beetle in the lodgepole pine stands of eastern Oregon and Washington, Idaho, Wyoming, and Montana is plainly apparent. In contrast to the trees selected under endemic conditions, it is the larger, thick-barked trees that are first attacked during epidemics. From these the infestation rapidly spreads until from 60 to 80 per cent of the total number of trees over large acreages are often destroyed.

From 6 to 8 years are required for an epidemic to pass through a given area and leave behind it a devastated forest. As these dead trees fall the resulting mass of tangled logs and tops is frequently swept by fire, causing the complete destruction of all the forest cover. No accurate data are available for the volume of lodgepole pine which has been destroyed during the past 20 years from the attacks of the mountain pine beetle. However, we do know that at the present time millions of trees are being destroyed each year, and strenuous efforts are being made to check these outbreaks

where the stumpage or esthetic values warrant the expenditures for control.

History of Control Work

The first effort to control an outbreak of the mountain pine beetle in lodgepole pine was made in 1910 and 1911 on the Whitman National Forest in northeastern Oregon. A great many projects have followed the initial attempt. Some have been carried out against small isolated infestations within a single creek drainage while others have been large-scale undertakings aimed to test the possibility of heading off the advancing infestation where no natural barriers existed. In recent years projects involving an expenditure of over $100,000 in a single season have been attempted. The total expenditures on some 15 to 20 projects between 1910 and 1930 have amounted to $300,000 involving the treatment of over 300,000 trees on approximately 600,000 acres.

Conclusions and Recommendations for Control Policy

The control projects that have been directed against infestations of the mountain pine beetle in lodgepole pine have covered a variety of conditions. Some of the outbreaks that have been combated have been large and others small, some have been increasing and others decreasing, in some cases 100 per cent cleanups have been attempted and in others control by partial cleanups involving a certain percentage of the infested trees. It is nevertheless fully realized that the available information concerning these projects is often incomplete, in the sense that results have not been followed up and the status of the infestation in the regions adjacent to the areas covered by control has not been determined. Generalizations taking into consideration all projects are therefore impossible. From the information available on more recent projects it would seem that the only conclusion that can be drawn is that the results of treatment are in rather direct proportion to the thoroughness with which the control work has been carried out.

In plans for the control of the mountain pine beetle the ability of this species to fly rather long distances should always be kept in mind, although experience with many infestations leads to the belief that long flights of this beetle probably occur only from the heavier centers of infestation such as exist in severe epidemics in lodgepole pine.

Observations over the past 30 years indicate that lodgepole pine forests throughout this region are inevitably destroyed when they reach a certain stage of maturity. In a way this is nature's method of harvesting and preparing for a new stand and would indicate that this tree species should be handled on a rotation short enough to avoid beetle epidemics.

The adoption of any control policy for the mountain pine beetle in lodgepole pine must be on the premise that an ounce of prevention is worth a pound of cure. To prevent epidemics adequate attention must be given to increasing infestations. A few grouped, insect-infested, but otherwise normal

trees should be regarded as much a potential danger as a smouldering fire. It is true that the adoption of such a policy of control will result in a much higher cost per tree for treatment than if control work is delayed until epidemic conditions exist. Nevertheless, if proper weight be given to considerations such as the present and expectation values of timber saved through the prevention of epidemics, the potential threat from active epidemics to stands of continuous type even 100 miles distant, the prevention of fires which result in even greater timber losses, and the complete alteration of forest types, which often revert to less valuable mixtures, it will be found that the prompt treatment of developing infestations is the most economical policy to follow.

On the basis of prevention of outbreaks, the following policy for control is recommended:

1. The making of annual surveys for red-top trees in all lodgepole pine forests, in order to locate all incipient outbreaks. Such surveys should be thorough, and a recognized duty of each forest officer responsible for the protection of the timbered areas under his charge.

2. The prompt and thorough control of the infestation by proper treatment or utilization of all infested trees. By thorough control is meant the treatment of as nearly 100 per cent of the infestation as is feasible within physical limits.

3. Should epidemics occur, the treatment of all infested trees over the entire area within one season is essential, and such treatment should be followed by annual maintenance control for as long as is necessary.

4. No projects should be undertaken without fairly accurate knowledge of conditions in all the surrounding watersheds.

5. If it is obvious that an outbreak is rapidly declining, no control measures should be undertaken.

6. Lumbering operations in forest types susceptible to insect attack, and the utilization of infested trees through salvage operations, should be encouraged. During such operations logs should be left in the woods for a period of three or four weeks during the flight of the beetles in order that they may act as traps for the insects by drawing their new attacks.

THE MOUNTAIN PINE BEETLE IN THE WHITE PINE TYPE IN THE NORTHERN ROCKY MOUNTAIN REGION

The mountain pine beetle can be found in all mature white pine stands, but it is in Idaho and Montana that the insect causes the greatest economic loss to this species. Endemic infestations are always present in the northern Rockies. In these the attacked trees are scattered throughout the forest and the resulting annual losses are less than 1 per cent of the total volume of the stand. Trees weakened and decadent from over-maturity, fire scorching, lightning, etc., are apparently preferred. The economic importance of such infestations lies not only in the actual destruction of merchantable timber, offsetting in many areas the annual increment of the stand and

eventually resulting in a complete elimination of this valuable species from the forest type, but in the leaving throughout the forest of thousands of inflammable snags that become a serious fire menace.

From time to time endemic infestations change rapidly into epidemics, which kill more than 1 per cent, though rarely over 3 per cent, of the stand annually, destroy enormous quantities of valuable timber in a few years, and then subside for a longer or shorter period of relative quiescence. During epidemics no selection seems to be shown by these insects for trees of any definite characteristics. The attacked trees may be scattered or may be in groups of different sizes, and during severe outbreaks groups of 75 to 100 attacked trees are not uncommon. The destructiveness of this insect can be more fully appreciated from the fact that in 1911, 1912, and 1913 a widespread outbreak occurred in the white pine stands of northern Idaho which destroyed at least 1,400,000,000 board feet of merchantable timber. During the past few years, beginning with 1927, there has again been a marked increase in the activity of this insect and at this time severe losses are occurring in all of the white pine forests of this region.

The factors contributing toward the development or decline of epidemics are little understood. The presence of an abnormal quantity of favorable host material resulting from windfalls, etc., undoubtedly is of importance, and varying climatic conditions may be of prime consideration though no definite correlation between such factors and bark-beetle outbreaks has been established.

An important characteristic in the activity of this beetle in the white pine type is that the adult flight is less marked than in the lodgepole pine type. This is because the white pine occurs more or less isolated in drainages usually separated from the next stand by a distinct change of type.

History of Control Work

Some fifteen distinct projects have been conducted against the mountain pine beetle in the white pine type from 1911 to 1930. Work has been done under a great diversity of conditions and includes the largest bark-beetle control project ever attempted, involving the expenditure of approximately $135,000 in one season on the Coeur d'Alene National Forest. Altogether nearly $200,000 has been spent in this work, requiring the treatment of over 40,000 trees, equivalent to some 20,000,000 board feet on 115,000 acres.

Conclusions and Recommendations for Control Policy

Until results are obtainable from several large projects now under way on the Coeur d'Alene and Kootenai national forests it is felt that final conclusions on the effectiveness of artificial control against the mountain pine beetle in the white pine type must be postponed. It appears, however, that much the same results have been obtained here as with lodgepole pine—results that are directly proportional

to the percentage of the infestation treated.

The policy to be recommended, therefore, is substantially that suggested for the lodgepole type. Less emphasis, however, need be put on certain features. Associated with the broken distribution of the host and the less active type of infestation there appears to be a relatively less marked tendency for long flight by the adult beetles, indicating that suppression measures of a more local character can be justified.

Because of the smaller percentage of the stand which is destroyed during epidemics it is possible, in considering the advisability of control, to give more consideration to the present stumpage values and the probable time of marketing the stand on any particular area.

The timber values at stake and the probable time of harvesting the stand can also be taken into consideration in deciding on the advisability of applying control to infestations killing less than 1 per cent of the stand annually. It does not seem advisable at the present time to recommend treatment of all endemic infestations.

THE MOUNTAIN PINE BEETLE IN SUGAR PINE IN CALIFORNIA AND OREGON

The habits of the mountain pine beetle in attacking sugar pine are quite different from those of the same insect in attacking lodgepole pine and western white pine. Whereas the outbreaks of this beetle in lodgepole pine and white pine in the northwestern region are characterized by centers of infestation made up of large groups of trees, infested sugar pines always occur singly or in small groups. The distribution of its attack is therefore quite comparable to that of the western pine beetle in the same region. To a certain extent this may be due to the fact that sugar pine always occurs in type mixture with yellow pine, white fir, and other species. Much of the endemic infestation in sugar pine develops first in the tops of large trees, and the attack is continued on down the trunk for two or three successive seasons before the tree is finally killed. Under epidemic conditions, on the other hand, large trees may be killed outright in one season, sometimes in groups of 5 or 6. The losses that result often represent high values, because trees from 6 to 8 feet in diameter, with a large percentage of clear lumber, are killed.

History of Control Work

Minor infestations of this beetle have occurred on nearly all western pine beetle projects in the West Slope type. These have usually been treated, although only incidentally to the control of the western pine beetle, and the results as relating to the mountain pine beetle can not be isolated to show what benefits, if any, were secured.

On four projects control of the mountain pine beetle in sugar pine was the primary object. These involved the expenditure of $14,000 for the treatment of 1,228 trees representing nearly 5,000,000 board feet on 64,000 acres.

Conclusions and Recommendations for Control Policy

Sufficient control work for this beetle in sugar pine has not yet been carried on to warrant final conclusions. The work that has been done up to the present time, however, indicates that this beetle is much more readily controlled than the western pine beetle, and that satisfactory results can be expected from one year's operations.

Control work is recommended, therefore, against increasing infestations in stands carrying a high percentage of sugar pine.

THE MOUNTAIN PINE BEETLE IN THE YELLOW PINE TYPE IN THE NORTHERN ROCKY MOUNTAIN REGION

Mountain pine beetle outbreaks in yellow pine are less aggressive but somewhat similar to those in white pine. A difference exists, however, in that practically no infestation is found in the yellow pine forests except during epidemics of the mountain pine beetle in lodgepole pine, when a certain percentage of the yellow pine adjacent to and associated with the lodgepole is always destroyed. It would appear that the yellow pine of Idaho and Montana is not a preferred host of this species. Furthermore, it seems that independent outbreaks of the mountain pine beetle in yellow pine will seldom occur unless as a result of some abnormal condition such as windthrows or fires.

There is one record of an outbreak of this insect in the yellow pine stands of the Snowy Mountains, Jefferson National Forest. In 1909 some 1,150 trees were treated at a cost of $358. This project was reported as being successful, and in 1910 only 8 trees were infested. The source of this infestation is unknown and little information as to the actual results obtained is available. It is reasonable to assume, however, that when outbreaks do develop in yellow pine prompt treatment of a large percentage of the infested trees with the adjacent lodgepole pines will be effective in checking them, and this tentative conclusion should be adopted at least until more experience has been gained.

THE MOUNTAIN PINE BEETLE IN LODGEPOLE PINE IN THE SIERRA NEVADA REGION

The lodgepole pine type in the central and southern Sierra Nevada differs from that in the northern Rocky Mountains, the Cascades, and northern California. Lodgepole pine in its southern range grows only at the higher elevations, and is usually quite common above the yellow pine-sugar pine-fir belts to the upper timber line. It prefers moist sites, and grows best along streams and around mountain meadows. Its distribution is much broken up, and no extensive areas of pure, even-aged stands exist such as occur in its northern range. The trees reach very great age and size, some of the veterans exceeding 4 and 5 feet in diameter d.b.h.

Under these conditions infestations of the mountain pine beetle rarely build up into epidemics in which large mass centers of infested trees are in-

volved. Under the endemic status, weakened or injured trees are attacked, usually singly, and seldom in groups of more than 2 or 3. The epidemic is characterized by indiscriminate attacks in groups of from 10 to 100 trees or more; but usually these groups are localized, and may continue for long periods in the same vicinity with about the same annual rate of killing. Only in Yosemite National Park, where some areas are found on which fairly even-aged stands of lodgepole cover several thousand acres, have such groups coalesced so as to form large masses of infested trees.

The epidemic just referred to, which developed within the Tuolumne River watershed of the Yosemite National Park, is, from the standpoint of damage, the most outstanding example of a mountain pine beetle outbreak in this region. The situation can not, however, be regarded as a normal one, for the mountain pine beetle outbreak was preceded by the work of a defoliating caterpillar, the lodgepole pine needle-miner (*Recurvaria milleri* Busck), which greatly weakened the trees and completely checked the growth of a high percentage of the stand. This defoliator, which started its attack some years previous to 1900, spread slowly through the tributary watersheds of the Tuolumne, and up to 1920 had covered about 30,000 acres. The bark beetle followed the needle-miner through the defoliated area, and between 1910 and 1924 killed approximately 500,000 trees. This epidemic subsided from natural agencies, however, after it had worked out of the defoliated areas.

History of Control Work

Projects for control in this type have been limited to national park areas, as no commercial value it attached to lodgepole pine. Five projects have been attempted, costing $3,275 for the treatment of 3,456 trees on 3,510 acres.

Conclusions and Recommendations for Control Policy

Since lodgepole pine in this region has little commercial value, control work need be considered only in parks and recreational areas.

1. Endemic conditions, as represented by attacks on weakened, injured trees, or by scattered attacks on healthy trees occurring singly, can be disregarded except where the removal of such trees is desirable for æsthetic reasons or for fire prevention on intensively-used areas.

2. Control work is feasible and should be considered where epidemic conditions, as represented by small or large groups of infested trees, exist. Such work is inadvisable, however, unless the control area is isolated, or unless all epidemic infestations within a fairly large area (several thousand acres) can be treated.

THE MOUNTAIN PINE BEETLE IN THE WESTERN YELLOW PINE TYPE IN CALIFORNIA

The mountain pine beetle is of secondary importance in both the East Slope and West Slope types. It occurs only in very suppressed trees or in association with the western pine beetle

in trees which have been killed by the latter. It is usually found with other secondary insects in the trees, such as *Ips emarginatus* Lec. The only epidemic of note which has occurred in this region was in the North Warner Mountains of Modoc County (1918-1921), where heavy competition existed between white fir and western yellow pine in the restocking of a 75-year-old burn. Here the mountain pine beetle killed practically all the pines, leaving only white fir on the area.

No control projects which primarily involved this insect and host have been undertaken in the region.

The Jeffrey Pine Beetle (*Dendroctonus jeffreyi* Hopk.) in Jeffrey Pine in California

This species attacks only one host tree, Jeffrey pine, and is therefore restricted in distribution and economic importance.

In mature stands the Jeffrey pine beetle usually attacks trees singly in very scattered distribution. In some heavy stands of pole size and larger in northern California, however, it has been found in groups of 10 to 20 trees killed in one season. The tendency to build up large mass centers of infested trees, as with the mountain pine beetle in lodgepole pine, has not been observed in this species. The heaviest losses recorded occurred in the Inyo National Forest in a stand of Jeffrey pine, where, in 1927, an infestation of 200 mature trees per section developed. This, however, was attributed to the influence of a heavy windfall within the area.

The only project on record concerned with the control of this beetle was carried out in Yosemite National Park in 1918. A total of 31 trees, with a volume of 60,820 board feet, was treated at a cost of $130.50. This work was followed by a reduction in infestation of 80 per cent the first year and a further reduction of 27 per cent the second year.

There is insufficient basis for control recommendations for this species, and it is felt that the formulation of any policy should await the results of further experimental work.

The Douglas Fir Beetle (*Dendroctonus pseudotsugae* Hopk.) in the Northern Rocky Mountain Region

This beetle is generally distributed throughout the range of its host tree, Douglas fir. In the commercial fir region of Washington and Oregon it plays a very secondary rôle and is seldom if ever of any economic importance. In the region east of the Cascades and in the Rocky Mountain Region of Idaho and Montana, however, it is responsible for the sporadic destruction of large volumes of Douglas fir. The infestation usually occurs as spot killings that continue over a period of years, though in the past few years rather extensive losses have occurred in northern Idaho and northwestern Montana from a rather general infestation. Throughout this region Douglas fir is of rather low commercial value, and the greatest concern is felt in the case of those infestations within the scenic forests of our recreational areas.

Since between 1909 and 1930 only four small control projects have been attempted, very little regarding the results which may be expected can be said until more experience in the control of this species has been gained.

The Black Hills Beetle (*Dendroctonus ponderosae* Hopk.) in the Central Rocky Mountain Region and the Colorado Plateau

The Black Hills beetle, potentially one of the most destructive of all the species of *Dendroctonus,* is generally distributed and of economic importance in the Black Hills of South Dakota and adjacent forested areas, in the Rocky Mountain region south of the Green River Basin, and on the Colorado Plateau south to the northern portion of Arizona and New Mexico. It attacks western yellow pine (*Pinus ponderosa*), lodgepole pine, limber pine, Mexican white pine, pinyon pine, white spruce, and Engelmann spruce. For the purposes of the present discussion this region will be considered as a unit and the insect treated only from the standpoint of western yellow pine.

The past history of this insect indicates that it is found endemic throughout the region in lighting-struck and dying trees or logs and is normally of but little importance. However, from time to time epidemics build up very rapidly and in a few years spread and destroy enormous quantities of timber. At such times the beetle shows no choice of trees of poor vigor or slow growth but on the contrary apparently prefers thrifty timber, taking practically all the trees above the smaller diameter classes (6 inches). Evidences of its destructive power are well exemplified by the Black Hills outbreak between the years 1895 and 1905 and the Kaibab epidemic between 1918 and 1925. In the earlier epidemic approximately a billion feet of timber were destroyed and in the latter approximately 12 per cent of the stand, amounting to 300,000,000 board feet. Little is positively known of the factors responsible for the rapid building up of these outbreaks or for their equally rapid and phenomenal decline. There is some indication that windfalls serve as a nucleus for building up the beetle population locally. Climatic influences are no doubt of considerable importance but from the evidence at hand the interpretation of these forces is not conclusive. Dr. M. W. Blackman's observations indicate that the sudden checking of the Kaibab epidemic was due to two very dry seasons which caused high mortality of the broods beneath the bark.

Past studies have also indicated that these insects readily attack felled logs and that continuous logging operations have a very beneficial effect in keeping down infestations. It is worth while in this connection to call attention to the fact that few outbreaks have developed since 1910 except in areas, such as the Kaibab and Colorado National Forests, where little lumbering was going on when the infestation built up. Several group killings indicating potential outbreaks have occurred in the Black Hills and Harney National Forests but were quickly suppressed through prompt utilization of the infested timber.

History of Control Work

The first attempt to control a bark-beetle outbreak was carried on against this species in the Black Hills National Forest in 1906, 1907, and 1908. Since then, up to and including 1930, at least 15 distinct projects have been attempted, requiring the expenditure of over $107,000 and the treatment of nearly 100,000 trees, amounting to 22,000,000 board feet, on an area of 372,000 acres.

Conclusions and Recommendations for Control Policy

The work attempted in the control of this species was frequently initiated without a very sound knowledge of the status of the outbreak. Furthermore, the work on two of the larger projects, and probably on some of the others, coincided with the natural decline of the outbreak. It is, therefore, obviously dangerous to draw very definite conclusions. However, if the extreme aggressiveness of this species, its potentialities for rapid increase under favorable conditions, and the fact that when epidemic it attacks the most vigorous stands, are considered in connection with the results of several properly timed and well executed control projects, it seems only logical to draw the tentative conclusion that prompt, thorough, and persistant control will effectively check outbreaks.

It is therefore recommended that, until further experience gives evidence to the contrary, the following policy be adopted.

1. Thorough annual reconnaissance of all yellow pine forests within this region in order to pick up incipient outbreaks.

2. Prompt and thorough control of the infestation by proper treatment or utilization of all infested trees, when the infestation begins grouping in clumps of 3 or more trees. By thorough control is meant the treatment of 100 per cent of the infestation within the limits physically possible.

3. When large epidemics develop, the treatment of all the infestation over the entire area in a single season is indicated, if physically possible, and this should be followed by maintenance control as long as is necessary. Surveys preliminary to control should include all the surrounding watersheds, as well as the area in which the outbreak is first recognized.

4. No control work should be done in case the infestation is rapidly declining.

5. The encouragement of local lumbering operations in the yellow pine type is desirable and these operations should, in areas of moderate infestation, be regulated to permit the green logs to be left lying on the ground during the flight period of the beetles. It is believed that this practice prevents the development of epidemics through trapping of the endemic infestation.

TRANSPORTATION PLANNING TO MEET HOUR-CONTROL REQUIREMENTS

By T. W. NORCROSS[1] and R. F. GREFE[2]

United States Forest Service

In the early days of the national forests the money provided for their protection against fire was sufficient for little more than the employment of a few men. With the greater funds now available it is possible to employ more men and to build roads and trails to make their efforts more effective. The proper location of these routes to give the fire-fighing forces quicker access to any portion of the forest requires careful analysis of the value and location of the resources, as well as the topography and the cost of road building, to make the money yield the greatest service. The authors discuss such an analysis and offer a technique for its preparation.

THE TIME ELAPSING between the start of a fire and the arrival of the suppression force is recognized as a fundamental factor in fire suppression activities, whether in a settlement, a national forest or elsewhere.

In laying out the fire suppression system for a city or town the controlling considerations include such matters as value of property, probability of fires, rate of spread and suppression costs. From such data it is possible to determine the time interval within which firemen should arrive at a fire. Part of this period must be allowed for detection and reporting the fire to the nearest fire station. Some time is needed to get the men organized and ready to start. The balance is available for traveling from the fire station to the fire, and this travel-time is the basis for decision on the number and location of fire stations, the number of men and the character and amount of equipment. The time requirements for report and get-away can be determined with considerable accuracy. The discovery time is apt to vary within a wider range; accordingly in planning the time available for travel, consideration must be given to the possibility that the fires may not be promptly discovered and reported. But back of all this planning is a determination of the expenditure justified from an economic standpoint.

Conditions in the national forests are closely similar. An objective governing protection activities has been set up. This is expressed in terms of annual allowable burned area to total area. This objective for purposes of planning and execution must be converted into terms of time. The first step is a determination of the necessary "hour-control", or the maximum time that a fire can be allowed to burn in a given fuel type under "average bad" conditions before the arrival of the first suppression force. Much time and thought has been given to this determination and several methods have been advanced. So far as known Messrs. Show and Kotok were the first to work out a method for determining "hour-control" for first-line defense in the national forest based upon

[1]Chief Engineer, U. S. Forest Service, Washington, D. C.
[2]Asst. Regional Forest Inspector, U. S. Forest Service, Portland, Oregon.

an analysis of past records in California. This has been published in Technical Bulletin 209 of the Department of Agriculture. No method of determining "hour-control" for second-line defense is yet available but studies and experiments are under way to that end.

The allowable "hour-control" varies with the objective of the protection system as a whole and should be such that the average annual burned area will be held within the maximum set as the objective. Since the success and accuracy of the protection plan as a whole is dependent upon a proper statement of the objective and of the hour-control intervals, these basic specifications should portray a true picture of the protection requirements of the unit.

The hour-control interval may be considered as divided into four parts, (1) detection, (2) report, (3) get-away and (4) travel. A proper division of the total time among these activities is essential. Detection time should be cut to the minimum justified from economic grounds. Report and get-away time are dependent upon communication facilities and upon efficiency of personnel. These time intervals can be determined with less difficulty. The travel-time allowance, from the standpoint of cost of the protection system as a whole, is most important. Every thirty minutes that can properly be cut from the other control intervals and allowed for travel may mean a difference of hundreds of thousands of dollars in the initial construction cost of transportation and other facilities required.

Once a standard of satisfactory performance has been established, the transportation system can be planned with a view to obtaining the prescribed promptness of control.

Briefly stated, the objective of transportation planning is the design of a transportation system, together with the placement plan for protection personnel, which at the least annual cost per unit of area will permit a fire anywhere within the protection unit being reached within the allowable travel-time. In other words, the purpose is to plan the most economical system of transportation facilities and firemen which will enable fire fighters to reach any fire within a certain travel-time, this time being determined by the value of resources, the degree of inflammability and consequent rapidity of action deemed necessary to hold losses below a specified limit.

A man located in the forest can reach any point in an adjacent area of certain size within a specified time. The size of the area that he can reach depends upon his location, the transportation facilities available to him and topographic and ground conditions. With no roads or trails available, the area that a man can reach within the allowable travel-time is roughly a circle with a radius equalling the speed of cross-country travel in miles per hour multiplied by the allowable hours of travel-time. If, however, the man were located at the end of a road or trail he would be able to reach one-half of the cross-country circle plus a triangle equal in altitude to the speed of the route in miles per hour multiplied by the hours

of travel-time and with a base equal to the diameter of the circle. If the same man were placed at a mid point along a road or trail he would be able to cover two triangular areas base to base, and from an intersection of two roads, two trails or a road and trail, a combination of four partially overlapping triangular areas.

With a man located along a road or trail, and with the speed of cross-country travel constant, the "reachable area" varies in proportion to the speed on the road or trail. Obviously a fireman located at the junction of two or more roads can cover far more area within a given time than if placed at the road terminus. As the rate of cross-country speed approaches that on trails, the value of trails as a means of increasing coverage decreases. Topography, drainage, ground cover and other conditions affect the speed of cross-country travel considerably.

To comply completely with the specifications, 100 per cent of the area should be reached within the prescribed travel-time, but planning on this basis will result in a large overlapping in coverage from various protective positions and certain relatively small areas can be brought within the allowable travel-time only at excessive cost. In planning the protection system, therefore, it is a matter of great importance that careful consideration be given to the percentage of coverage and a correct determination made of the allowable variation from 100 per cent. Where such a determination has not been made, the latest instructions for the transportation planning provide (1) that not less than 80 per cent of the total area shall be within the prescribed travel-time, (2) that the area of any unreached block shall not exceed a stated percentage of the entire area and (3) that practically all points in such a block shall be within a travel-time fifty per cent greater than that specified for the surrounding territory.

The necessary coverage can usually be secured with several different layouts of transportation facilities and men. It is relatively easy and requires little time to work out a system that will make the entire area accessible within the allowed travel-time. The objective, however, is the system which at the least annual cost will satisfy the travel-time requirements.

The difficulty in planning arises in finding the best possible combination of men, roads and trails. The men in charge of the planning must repeatedly answer several questions. Should men only be provided or should there be a combination of men and trails; men and roads; men, trails and roads? How many men are needed and where should they be located? What should be the speed standard for the roads and trails? Obtaining a satisfactory solution would be well-nigh hopeless if aids to the determination had not been provided. For various combinations of speed of roads, trails and cross-country travel, allowable travel-times, annual costs for firemen, roads and trails, tables and graphs have been prepared which show the cost per square mile and the most efficient distance between firemen.

The layout upon which the tables and graphs are based can seldom be completely attained under field conditions. In using the data, the planner must consider topographic and ground conditions, firemen locations controlled by reasons other than availability for going to fires, variations in annual costs for roads and trails and similar matters. These aids to the planning are maintained as a guide only, to determine the nearest possible approach to the assumed system in which cost of projects average the same as those on the ground. The tables serve as a guide to the most economical layout of roads (or trails) and men and eliminate by far the greater part of the cut and try methods otherwise necessary.

In building the transportation plan, a clear statement of objectives is the first step, followed by a set of specifications based upon such a statement. These specifications cover the allowable travel-time, both first-line and second-line defense, for all portions of the area for which the plan is made. In the specifications there should be listed, for each fuel type or zone of inflammability, the travel-time allowed to reach the area with (a) first-line defense and (b) second-line defense.

First-line defense, as used in the planning, ordinarily consists of one man available for dispatching to a fire at any time but a larger number is used when the conditions show that this will be more efficient. In this classification are included firemen and lookout firemen and also patrolmen who are on the telephone at regular short intervals. Primary lookouts who are not allowed to leave their stations are excluded. District Ranger and Dispatcher headquarters, warehouses, etc. at which there is always a man under permanent or temporary appointment and available for fire use may be considered as first-line bases.

Second-line defense bases are defined as cities, towns, logging camps, mills, mines and other points where it is possible to secure fully equipped crews of not less than the minimum size required for second-line purposes in the area covered from the base. Camps of short-lived duration are not considered. The minimum size of crew is no greater than that normally required to handle the average fire within the tributary territory. If no well defined second-line bases are available, or if inadequate in number, it is frequently possible to designate points at which stockmen, ranchers, small crews or other local residents may be concentrated in sufficient numbers for second-line purposes, deducting the time required to concentrate the crew from the total second-line travel-time allowed.

Throughout the planning, road, trail, and other construction crews of a similar nature, as well as unorganized local residents, are not considered for any definite coverage because of their shifting position and strength and because the road and trail crews, except those on maintenance work, will not be available when the planned system is done. They serve as reinforcements only for the first-line defense.

The design, speed ratings and cost

estimates of roads, presuppose that first-line men on or near roads are equipped with light cars of the Chevrolet-Ford class, and the second-line forces with 1.5 ton capacity trucks of the same class. The design of roads for vehicles of larger size is considered only when specifically authorized by the Regional Forester. Design and speed rating are based upon vehicles with rated loads only.

The next step in planning is to secure from the field all information and data necessary for making the plan. The man in charge of the planning must be reasonably familiar with forest conditions through field contact. He will need to know the location of each existing road and trail, what speed can be made over it during the period when the road or trail is required for suppression activities, what it will cost to raise the speed standard and the present and proper annual maintenance cost. Similar data are needed on all proposed and possible routes for roads and trails within reason as to cost, and in addition the required construction expenditure to build to different standards and to produce different car or truck speeds. Similar information is also needed for water routes. The possibility of utilizing existing airplane landing fields or building new ones may have an important bearing on the transportation plan.

Not all of this information can be secured first hand by the man in charge of the planning but he should if possible (a) cover the entire road mileage, (b) cover enough trail mileage to acquaint himself with costs, standards of construction and general topographic and timber conditions, (c) visit as many lookouts as possible in order to gain as complete a picture of the forest as possible, (d) cover any country regarding which reliable data on possible road or trail locations cannot otherwise be secured. He should also secure the regular Forest Service road and trail plan maps and tabulations, available topographic, logging, water power or other maps, and photographs, particularly from lookouts or airplane.

The actual making of the transportation plan can then be started. The method shows the present efficiency of the existing system for first and second-line defense (Overlays W and X on Map B Figures 3 and 1) and develops from the existing system a planned system (Overlays Y and Z on Map D Figures 5 and 6) which will satisfy the specifications.[3]

The specifications state the allowable travel times for individual portions of the area. These are shown on Map A for first-line defense and Map A-1 for second-line defense. The area within each travel-time zone is shown by different forms of hachure. Usually two or more travel times are specified on a forest for each line of defense, but for simplicity the illustra-

[3]Maps A and A-1 and Overlays X and Z have been omitted. The author states that "Maps A and A-1 would be very simple—consisting only of the maps showing the areas within the different travel time zones. Overlays X and Z would be very similar to Overlays W and Y. However the areas reached from the second-line bases will not be exactly the same as those reached from the firemen locations."

tions herein given are based on only one travel time being used. If cover types occur in reasonably compact bodies, the zoning is simple. If the types are irregular, elongated, or "shoestring" in shape, good judgment in drawing the zone line is required. It is clearly impracticable to follow type lines exactly. Small areas of the lower hazard type must be included in the higher zone and the projecting areas of the more inflammable types must be thrown to the lower class.

The planning can usually best be done on maps of one-half inch to the mile scale or larger. One-quarter inch maps are too small in scale for accurate recording of data. One-inch maps are awkward to handle but in some cases where extra refinement or detail is necessary their use may be desirable.

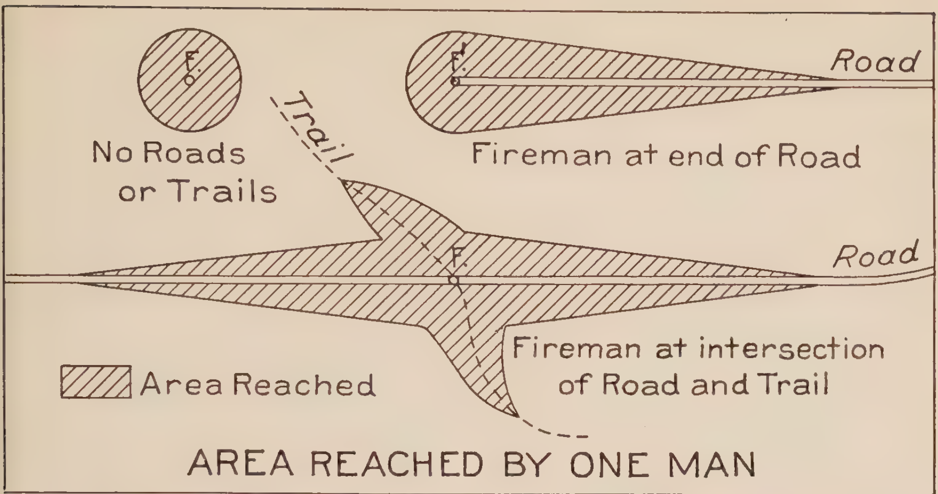
On Map B, Figure 1, is shown in distinctive colors or symbols, existing travel routes, existing protective positions used in fire suppression, and second-line defense bases. The light car, truck, foot, horse or boat speed for each route is shown by special symbol. Miscellaneous personnel constituting the support line is not ordinarily shown.

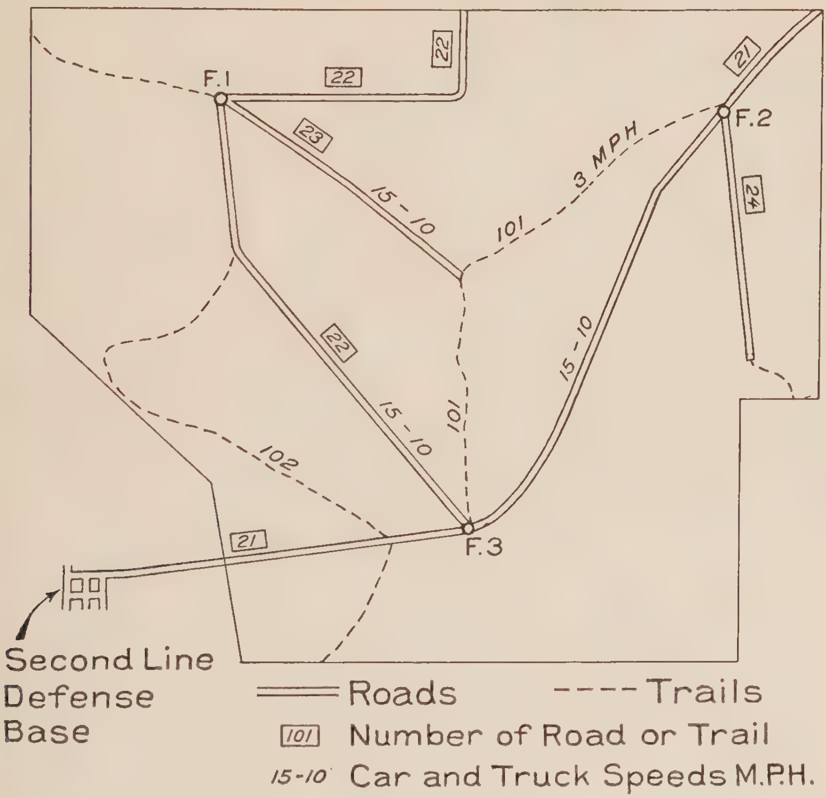
Transparent Overlay W, Figure 3, is next placed on Map A and the first-line travel time zones traced upon it. The overlay is then placed on Map B, Figure 1. Starting with the first fireman, and using the proper speed for each existing route or travel, the area which he will be able to reach within the prescribed travel-time is worked out step by step on the overlay. For instance, if the allowed travel-time is 2 hours, and the fireman is located on a road with a speed standard of 15 miles within an hour, he will be able to travel 30 miles in each direction within the allowed time. With a cross-country speed of 2 miles per hour, he will be able to go out 4 miles on each side of the road opposite his station, 3 miles from a point on the road 7½ miles away from his station, 2 miles out when 15 miles away, etc. In plotting coverage, consideration is given to topographic and other conditions affecting the speed of cross-country travel and also to intersecting roads and trails. Small errors in plotting coverage are to be expected, but the area which a man will cover within allowable time limits can be shown with reasonable accuracy.

Each man is considered as equipped with that means of transportation best suited to his location, i.e. a car for road use, a speeder for a logging railroad, a boat for a water route, etc.

The area covered by any one existing fireman within the allowable time limits is shaded lightly in color. Every possibility is canvassed to make sure that advantage has been taken of all existing routes and that the shading shows in full the area that the man covers in the time that he is allowed. Following the above procedure, and utilizing all existing routes of travel, the coverage yielded by each protective position is plotted in turn. By using different colors the average of each man and any overlaps of coverage are shown to best advantage.

Transparent Overlay X is placed on





MAP "B"
FIG. 1.--EXISTING ROUTES

Map A-1 and the second-line travel time zones traced upon it. The overlay is next placed on Map B, Figure 1. Using each second-line defense base as a starting point, and substituting truck speeds for light car speeds, the area reached within second-line time limits is plotted. As on Overlay W, Figure 3, every combination of existing routes, roads, trails, water, cross-country, etc.—is utilized to show the full area capable of being covered at present.

A computation is then made of the annual cost of the existing system. This is based upon area reached within the specified travel-time by first-line forces. For roads and trails, the annual costs include the annual maintenance costs necessary for protection use and paid by the Forest Service plus 2 per cent of the construction investment required to build to the standard necessary for protection. For firemen, the annual costs include such portion of the wages including costs of board, as are chargeable to protection. For improvements at firemen's stations, the annual costs are such portion of the annual depreciation plus annual maintenance as are chargeable to first-line defense.

The cost figures described represent only a portion of the true present cost of protection activities. To secure the total, if desired, it is necessary to include all annual costs for detection, communication, suppression, and the like.

The planning work so far done has shown to what extent the present transportation system and protective organization fulfill the requirements. The next step is a determination of the best means of improving the system to a point where it will satisfy the specifications.

The probability is that Overlay W will show a great duplication in coverage in certain sections and that other sections will be far outside the travel-time allowance. The first question is whether the existing situation can not be improved with little or no increase in present annual expenditure. In one case it was found that one fireman added no new coverage to that available from other firemen. So far as coverage was concerned the expenditure for this fireman's wages, subsistence and shelter was wasted. If the percentage of coverage for the forest had been satisfactory, he could have been dropped from the organization and the expenditures decreased accordingly. However a rather large area was not within the specified travel-time. By shifting this man to another location and without constructing any new roads or trails, the percentage of coverage was substantially increased and the annual expenditure not changed. Such cases of 100 per cent duplication in coverage will probably be infrequent but Overlay W will show many instances where the coverage can be improved by changing the location of firemen and by comparatively minor expenditure in raising the speed standard of existing roads.

Map C, Figure 4, is next prepared. On this is shown all proposed and possible routes of travel which seem

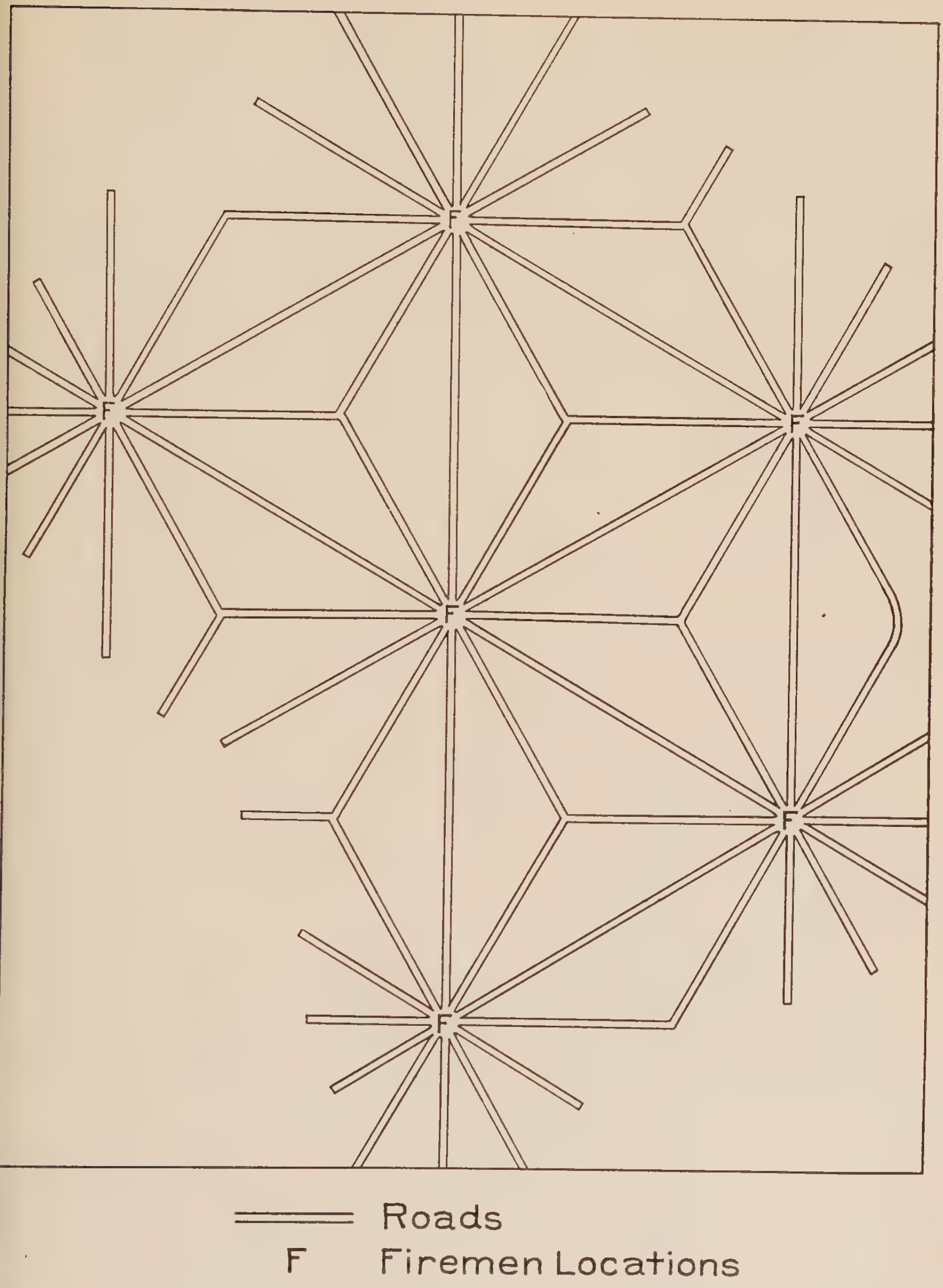


Fig. 2.—Assumed system upon which tables and graphs are based.

practicable from the standpoint of cost.

Overlay Y, Figure 5, bearing the first-line zoning is used over Map C. On this overlay such coverage as is obtained from men properly spaced and located is traced from Overlay W, Figure 3. The tables and graphs, previously described, are used as a guide in extending the system. Men are shifted where insufficient or duplicate coverage dictates. New positions are introduced where needed. Existing routes are altered in speed if necessary or abandoned if found of negligible value. Proposed or possible routes are utilized when required and assigned the speeds found most economical. The final result of this step should be a coverage of not less than the minimum percentage specified as acceptable, and a transportation system approximating as closely as practicable in ground plan and speeds, the guiding figures in the tables and graphs for like conditions.

On Map D, Figure 6, are plotted all existing, proposed and possible routes used in securing the first-line coverage shown on Overlay Y, Figure 5, together with light car and truck speeds specified for each road.

Overlay Z with second-line zones shown, is then placed on Map D. Starting from the second-line supply points shown on Map B, second-line coverage is worked out, using the method followed for Overlay X.

It is extremely unlikely that the crew coverage upon first trial will be satisfactory. If it is, the system satisfies the specifications for both first-line and second-line defense. If not, changes must be made on Map D to secure the required second-line coverage. These changes will usually consist of substituting roads for trails and increasing the planned length or speed of planned road projects.

After completing Overlay Z, Overlay Y is again placed on Map D and reworked for first-line defense in the areas affected by the changes just made. If additional changes are found necessary, a check of their effect upon Z is required. Through balancing back and forth between first and second-line overlays, the final system is determined.

Unit costs for the planned system are then computed in the same manner as for the existing system. If found higher than the allowable maximum annual cost, it becomes necessary to revise the travel-time specifications downward and repeat the planning until a system is secured which satisfies the requirements of coverage and cost.

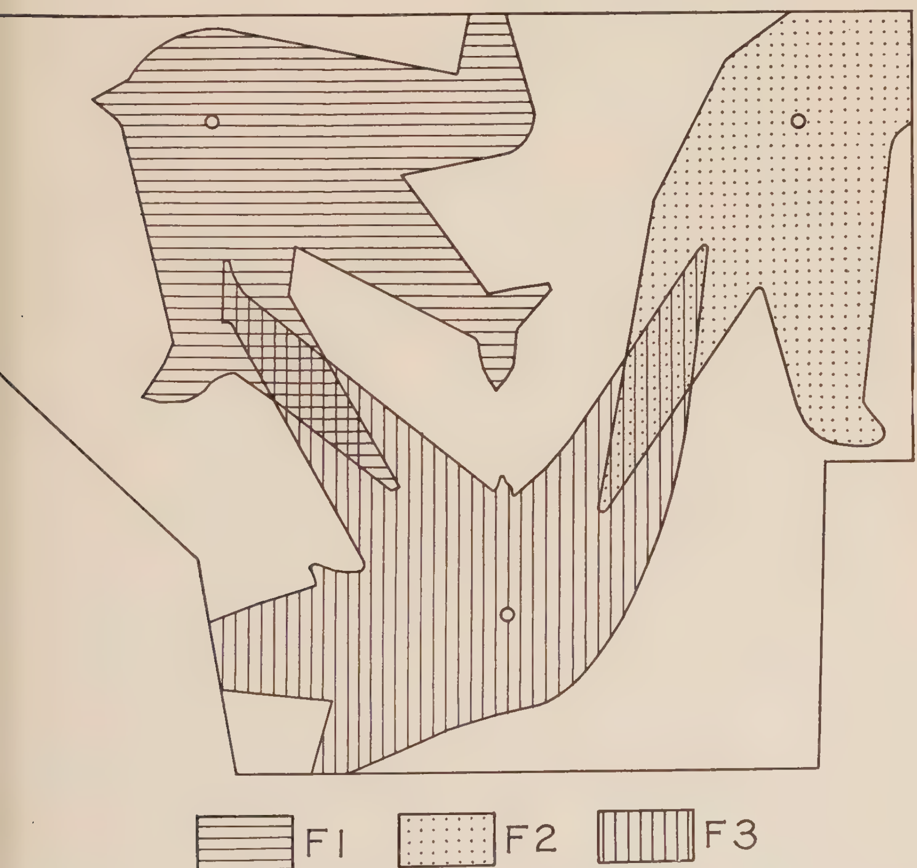
Variations in the mechanics and order of steps in the planning may prove advisable because of unusual conditions. For instance, if apparent that second-line defense will require roads considerably in excess of first-line needs the second-line planning (Overlay Z) should precede that for first-line. Or in certain cases, where due to lack of nearby second-line supply bases it is impossible to secure adequate second-line coverage, the use of air transport to supplement ground travel may be practicable.

The plan when once made is not

nal. Not only may means of im-rovement be found, but periodically ringing it up to date to show the ffect of changes made since the plan s first made should result in decided ssistance to administration and pro-ection activities.

The final inspection and check of he plan will be made in the field and over (a) the feasibility of planned outes, (b) correctness of cost esti-nates, (c) practicability of securing planned speeds on planned locations at estimated costs, (d) suitability of construction standards called for, and (e) correlation of planned locations with needed routes for utilization and other purposes.

In brief the steps involved in a study for the purpose of converting the protection objective into terms of roads, trails, firemen, improvements and protection facilities are as follows:



OVERLAY "W"

Fig. 3.—Coverage from "B"-First Line Defense.

1. Protection objective expressed in terms of percentage of allowable burned area to total area.

2. Determination of time requirements to carry out (1) for (a) first-line and (b) second-line defense.

3. Splitting of (2) into (a) Discovery time; (b) Report time; (c) Get-away time; and (d) Travel-time.

4. Planning of transportation system and placement of men which at the least annual cost per unit of area will permit all portions of the area being reached within allowable travel-time. This requires intensive consideration of all possible arrangements of transportation facilities and men that will meet the specifications of construction and maintenance costs.

5. Providing the roads and trails of the mileage, location and speed standard upon which the approved transportation plan is based. The duty or service value of each road or trail is expressed in travel-time.

6. Selection of the construction type making possible securing the required duty or service value at the least annual cost.

7. Selection of construction equipment, methods and organization assuring accomplishment of construction at the least cost.

8. Selection of maintenance equipment, methods and organization assuring accomplishment of maintenance at the least annual cost.

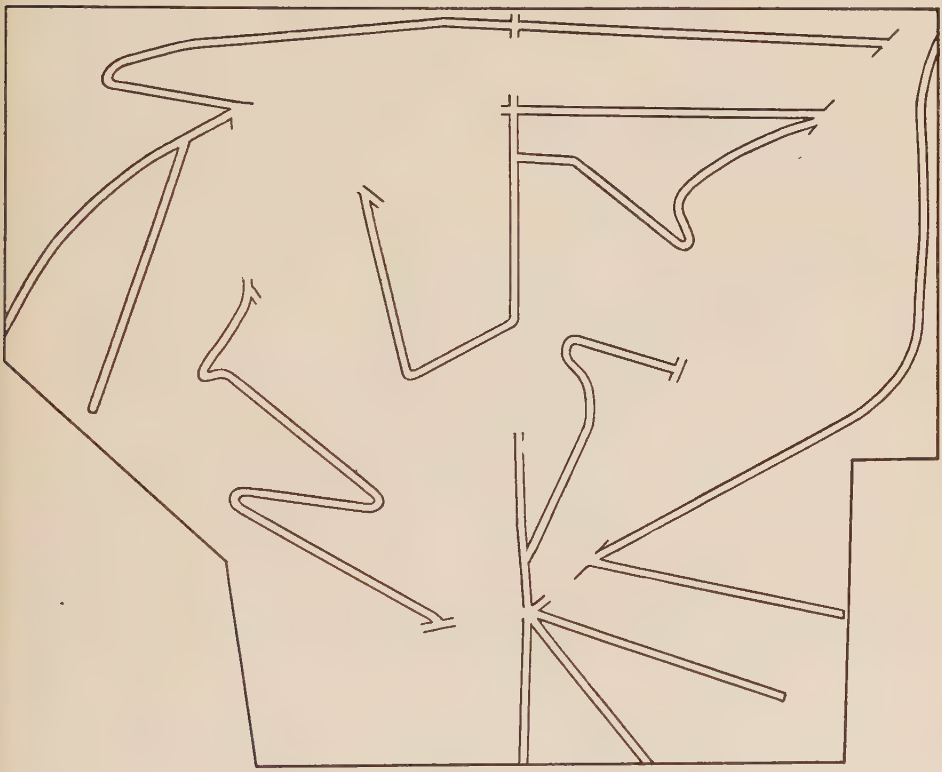
Effectiveness in expenditure requires close correlation between the transportation plan and the detection plan. While both plans could be made independent of each other, possibility exists of so locating some men that they may serve both for detection and suppression. An adequate means of communication is essential to both the transportation-suppression system and the detection system. When these two systems have been worked out, it appears that it will be relatively easy to determine the communication system which at the least annual expense will render adequate service for protection as well as for administration.

In the case of state, municipal or privately owned units, transportation planning will be found equally valuable. The method is also well adapted to planning the transportation system for purposes other than protection since elapsed time—the basis of the method—is a satisfactory indication of the service value of the road. The exceptions are timber utilization and other roads of similar service.

Another use of the plan is in selecting each year's road and trail construction program. Some 25 years or more may elapse before the transportation system is done. Annually decision must be made on what use of the then available funds will bring the largest areas or the areas of greatest risk within the required travel time. The plans offer a means of reaching such a decision. For instance, $10,000 may be available. If used on a certain road, the plans indicate an increased coverage of 40,000 acres. With another road, the coverage may be enlarged 80,000 acres. Other things being equal, the second road is entitled to priority.

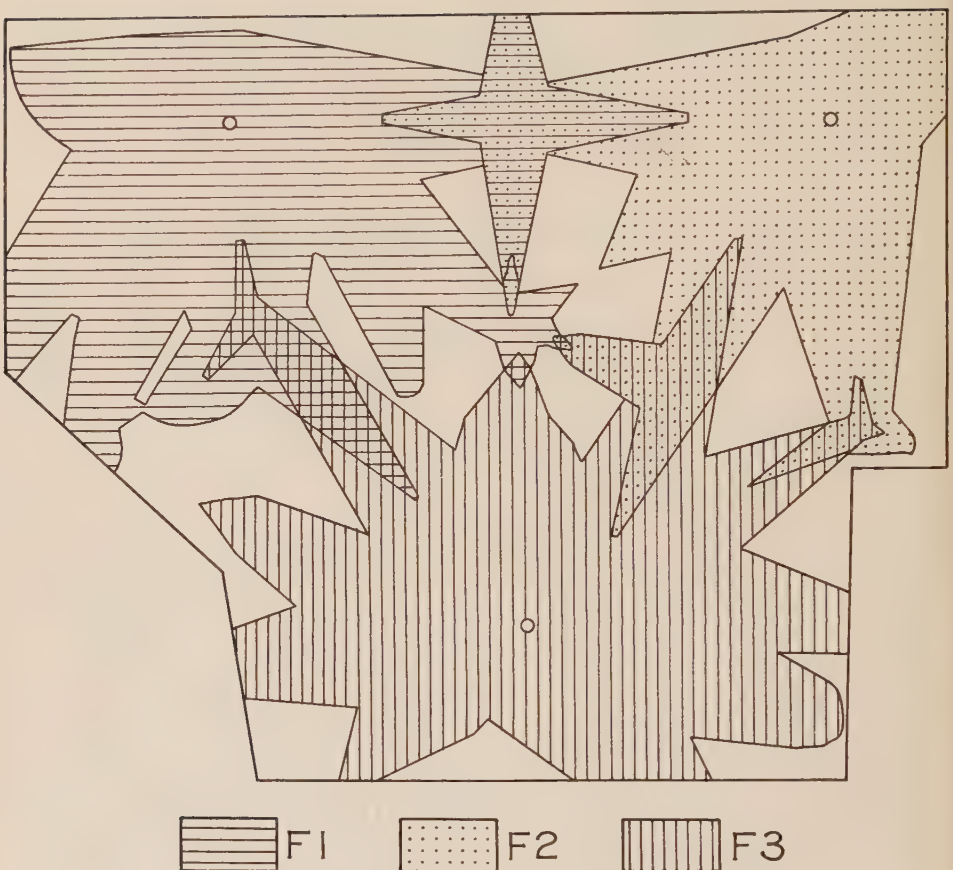
This method may be utilized in making analyses of administrative and recreational use problems, the placement of men and crews for various purposes in improvement and other work, the size and number of ranger districts and the location of ranger stations. Knowing the latter will aid in mapping out a program of station improvements and the communication system with greater assurance than would otherwise be possible.

Primarily devised as a protection aid, the planning method adapts itself to the solution of a variety of problems in which the elements of men, travel routes, time and costs are involved.



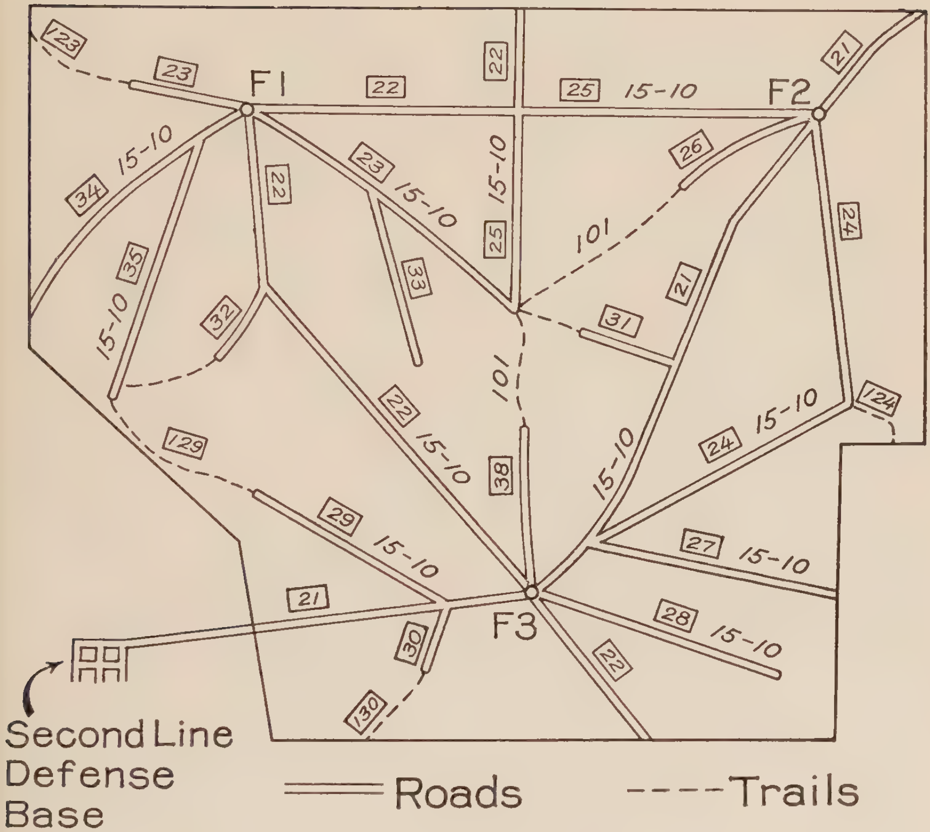
MAP "C"

Fig. 4.—Proposed and possible road routes.



OVERLAY "Y"

Fig. 5.—Coverage from "B" and "C" using routes and firemen locations that will give 80% coverage at least annual cost.



MAP "D"

Fig. 6.—All routes used to get coverage shown on "Y".

FOREST FIRE DAMAGE APPRAISAL

By E. H. MACDANIELS

Inspector, State Coöperation, U. S. Forest Service

As far as the forester is concerned, timber is sold when fire destroys it, whether the stand burned is ten years old or one hundred years old. The appraisal of mature stands presents few problems. A satisfactory yard stick for valuing immature stands has not yet been devised, but the author describes a method, recommended for use in Oregon and Washington, which deserves carful consideration.

APPRAISAL of damage to immature stands of timber resulting from forest fires has been one of the minor difficulties of protection agencies for a long time. It has been a minor difficulty chiefly because the assumptions that all forest land must be protected, and that all the money that can be raised for the project is none too much, have been widely accepted. It has occasionally led zealous administrators, in their efforts to get proper recognition of their respective services, to overstate the case. Heavy expenditures for protection must be justified by the prevention of heavier losses; since the losses are somewhat indefinite, the tendency has been, as a rule, to make these expenditures unreasonably heavy. Estimators of damage of this school run through a series, starting with mild exaggeration and ending in what appears to outsiders to be plain hysteria.

Opposed to this is another school of administrators who are more matter of fact. They look about at the mounting tax delinquency of cut-over lands and the state of the market and reach a different conclusion. Immature timber, they reason, in itself has no intrinsic value. It cannot be manufactured into a usable product. It is cared for only because it is believed that there will be need for timber 60 years old, and 60-year-old timber is impossible without first having 10-year-old trees. But there is at present a notable overproduction of lumber. The price of high quality material is down, and immature timber goes begging. The tendency is to assume that the going price reflects the true values, and that when young growth burns, no particular harm has been done. Reproduction cannot be used, their logic runs, unless someone takes care of it until it grows up; the timber industry shows few signs of holding its cut-over lands that long; therefore, the young timber will not grow up. Therefore, when it burns, the loss is zero. This conclusion has the advantages of showing small losses—hence an inferred efficiency on the part of the fire wardens.

It has been impossible to correct this situation because definite information is scarce. Almost every statement of loss has something in the way of fact behind it that makes refutation difficult without starting a major research project. Among other things which are not known with any degree of certainty are; how much wood will

be needed; how much land it will take to produce it; how much damage a light fire does in the various types and conditions, and so on. Skepticism about a lurid account of losses running into millions of dollars merely starts an argument, in which each side is haunted by the fear that events may prove the other to be the more nearly correct. As a result, estimates of the most diverse sort have been lumped and given to the public, all unedited. The discrepancies that necessarily show up invite criticism, and get it. Advocates of forest insurance complain, with good reason, that the reports of huge losses have kept responsible insurance companies out of this field. Owners of mature timber state that an incorrect impression is given the buying public, who refuse to be interested in what is in reality a safe risk, so far as fire is concerned. Opponents of conservation jeer at the inconsistencies—not to say absurdities—in the data on fire losses. This unquestionably weakens the case for protection. Overvaluation of immature timber stirs up the tax assessors; under-valuation raises doubts about the advisability of paying good money to protect property worth less than the tax.

The amounts put into protection now run to a very respectable sum, and as such, they get more than the casual notice that was sufficient when they were small. Loose appraisals of damage by fire cannot be expected to be accepted much longer. Accurate appraisal is becoming of first importance. The damage done by fires should be a substantial part of the basis upon which budgets are made and protection forces are organized; it should largely determine how much money should be spent, or whether any should be spent in a given unit. Emphatically, it is no longer a matter to be disposed of by making a perfunctory figure in the small space on the fire report form usually allotted to this purpose.

All this is easy to write; not so easy to put into effect. A small start has been made in the statement of the "permissible area" burned in the various forest types, now in use. The next step might well be some provision for collecting the data concerning losses from fire so that they will be consistent and comparable for the different units, and sufficiently correct to be defensible.

Such a plan must allow for the fact that the men who will collect the data are, as a rule, not foresters nor statisticians. They are supposed to be good laborers, able to get around in the woods. Sometimes they know a little about cruising timber; for the most part, they will have to be taught, and the opportunity for teaching is small. The plan, in consequence, should be simple. It must of necessity reject the idea that young growth has no value because it cannot be sold, or in some cases, even given away. There must be an assumption that it will (excepting normal losses) mature, be harvested, and bring a sale price; and that it has a value in proportion to its progress toward maturity and not dependent upon local or periodic depression.

In the spring of 1931, such a plan was worked out by a committee of

the Western Forestry and Conservation Association, for Washington and Oregon, and is now in use in these two states. An adaptation of it is also in use in Montana. An effort was made to devise a fire report form which would, when filled out, provide the data needed to keep the economic survey up to date, give the insurance study the information it needs, make a rough appraisal of damage and show the action taken on each fire for administrative use. A number of methods for appraisal had been suggested. They are discussed in the following memorandum prepared and adopted by the committee:

Information needed in the Pacific Northwest for making an appraisal of damage may be put under the following headings: Site Quality, Rotation, Price of Product, Yield, Age Classes, Accessibility, Severity of Burn, Density of Stand, and Carrying Costs.

Site Quality. West of the Cascades, most private timber lands are on comparatively good sites. We may assume that the average is Quality 2, where five classes are recognized and Quality 1 is the highest. In the western yellow pine region, Quality 4 is the average. With this assumption as a guide for production, height, etc., no mention of site quality need be made in the fire report.

Rotation. The shortest rotation to reach merchantable size. In Oregon and Washington on Quality 2 sites, the sitka spruce-western hemlock type reaches pulp size in 40 years; Douglas fir reaches tie size in 60 years; western yellow pine reaches sawlog size in 100 years. These periods, plus a 10-year restocking period, should be used. Ten years is suggested because it will include two or more seed years, and on the average should be sufficient if a seed supply is available and fire is kept out, although this has been questioned; twenty years has been suggested as more in accord with the facts, and may be a better figure.

Price of Product. Current stumpage prices for the region and quality should be used. Stumpage may go up—it is hoped that it will. The price of iron, wheat, wool, and other staple raw materials may also go above the average for the last decade, but it is by no means a certainty. It is assumed that there will be no shortage of wood to force the price up, because enough can be raised to meet ordinary needs, and back of that are the foreign supplies and substitutes. The prices suggested for pulpwood are $1.00 per cord; for Douglas fir and western yellow pine sawtimber, $3.00 per thousand board feet.

Yield. The yields actually found growing in most well-stocked stands at the ages mentioned above are pulpwood, 60 cords per acre; Douglas fire, 35,000 feet board measure per acre (Scribner); western yellow pine, 15,000 feet per acre. These stands have been thinned by fire and accident to a point well below a normal stand, and the figures therefore make allowance for insurance or normal loss.

Age Classes. In well-stocked stands of Douglas fir, sitka spruce and western hemlock, the crowns close and

forest conditions are established at an age of somewhere around 20 years. After this point, the hazard declines sharply; a definite stage in the growth of the stand is passed. This group may be called Age Class 1.

In the pulpwood type the remaining twenty years of the rotation—trees 20 to 40 years old—constitute Age Class 2.

In Douglas fir the stand, during the age 20 to 40 years, has little value except for fuel. Exploitation is a long way off, and values do not show much. This intermediate class might be omitted, but it has characteristics of its own and is a convenience. This may be called Age Class 2. The class 40-60 years old is Class 3.

In western yellow pine stands, there is no clear-cut division of age classes, and the rotation is much longer. There is a sort of dividing point around the age of 50 years. Before that point, it is apt to be slow-growing, with the characteristics of reproduction and little value apparent. After the point is passed, it becomes an open stand of "bull" pine and begins to look like timber. Two age classes of 50 years each are about all that can be provided for western yellow pine.

Total height for a known age class is an index of site quality. If the site quality is known or assumed, as in this discussion, total height may serve as an index of age. It has the advantage of being the most conspicuous dimension, and the one easiest to estimate. For our purpose, it will serve to distinguish the age classes better than any other characteristic. Age Class 1, Douglas fir, sitka spruce and western hemlock, may consist of reproduction in which the dominant and co-dominant trees are 30 feet tall or less. Age Class 2, stands 30 to 80 feet tall; Age Class 3, Douglas fir type, 80 to 125 feet tall.

In western yellow pine, Age Class 1 includes reproduction in which the average dominant and co-dominant trees are less than 25 feet tall; Age Class 2, of trees 25 to 60 feet tall.

Stands taller than these heights will be considered as merchantable timber, and loss will be computed at going stumpage rates.

Accessibility. Two zones may be recognized. Timber within, say, 15 miles of a market, drivable water, or common carrier railroad, may be considered accessible; timber at a greater distance, or where expensive improvements are needed to exploit it, inaccessible.

Severity of Burn. In young stands, even a light burn is likely to be more severe than it appears to be. In the case of a number of fires in the pulpwood type, examined a year or more after the five occurred, the loss of mature spruce and the true firs was 100 per cent; of hemlock and cedar, about 75 per cent; of mature Douglas fir, 14 per cent. In each of these cases, the damage was reported as "none" or "slight." The damage does not become evident until the following year. If one considers the loss complete from any fire in both age classes of the spruce-hemlock type, he is not far off. In Douglas fir and western yellow pine a "light burn" is

one that destroys less than half the stand, and a "heavy burn" one that destroys more than half.

Density of Stand. In planting and land exchange work, 1,200 seedlings to the acre has been considered a full stand; more than 600, satisfactory; 100 to 600, fair; less than 100, poor or unstocked. Dense groups of young trees are not counted. Only the well distributed plants are considered a part of the stand.

A method recently worked out in national forest Regions 1 and 6 puts the emphasis on distribution. At the age of 40 years, 250 well distributed trees per acre make a complete stand. Each occupies on the average an area equal to a square 13.2 feet on each side. In making an estimate of the stand, the area is laid off in plots of this size, and the number of them that contain one healthy seedling counted or estimated. If over 70 per cent of them have one healthy seedling each that has lived through an entire year, restocking is good; 40 to 70 per cent, fair; 10 to 40 per cent, poor; less than 10 per cent, unstocked. If a square contains several trees, only one is counted. Repeated counts have shown that if 70 per cent or more of the squares are occupied, there are actually 750 to 1,000 trees or more per acre.

This system is as easy to apply as any. It is adapted to either close work or to a casual estimate, such as is generally used for filling out fire reports. A casual estimate that there are 10,000 trees per acre does not give the information desired. It may and often does mean that one-fourth the area is overstocked with trees most of which will not survive, and the rest of it is unstocked or understocked. The statement that 70 per cent, or 40 per cent of the squares have a tree on each of them is precisely what one wants to know.

Further, if a fire has run over a young stand, killing some of it, the extent of the damage is difficult to estimate by the old method. A statement that three-fourths of the stand was killed does not mean much. But if an examination shows that a square contained four trees and the fire killed three of them, leaving one in good condition, the square is still fully stocked and no particular harm has been done.

Having assembled the data, there remains computation of values. An insurance company or court would award damages on the basis of sale value, or if this cannot be established, on the cost of producing the crop destroyed, or the cost of replacing it.

Carrying Charges. West of the Cascade Range in Oregon and Washington, the land tax is fixed by law at about 5 cents per acre and protection costs average about 5 cents per acre. A total of 10 cents per acre per year for carrying charges is a fair figure and 4 per cent interest, compounded, is permissible.

In the western yellow pine region, the average cost of protection is about 3 cents per acre; and the tax or forest fee is 5 cents in Oregon, and about 2 cents in Washington. This gives a carrying charge of 8 cents per acre in Oregon, and 5 cents per acre in Washington.

On this basis, the average investment in the different types and age classes totals to the figures given in Table 1.

The results were obtained as follows: average age of Class 1, 0 to 20 years old, is 10 years. Adding a 10-year restocking period, gives 20 years for the period that annual payment of 10 cents per acre has been made.

The average of Class 2 of above types is 30 years, plus the 10-year restocking period.

The average of Class 3, Douglas fir, is 50 years, plus the 10-year restocking period.

For western yellow pine, the average of Class 1 is 25 years, plus a 10-year restocking period. Class 2, 75 years, plus the 10-year restocking period.

These values are low for the best sitka spruce and western hemlock, rather high for Douglas fir, and exorbitant for western yellow pine, but the method has advantages.

The Straight Line Method. Another course for arriving at the fire damage that is sometimes suggested, is to compute the gross income at the end of the rotation; subtract the yield tax and the cash outlay for protection and annual taxes, which gives the net income; divided by the number of years in the rotation, which gives the average annual increment; and multiply by the age of the stand, starting at the beginning of the restocking period. By way of illustration take a 10-year-old Douglas fir type fully stocked stand, Zone 1, $3.00 per thousand board feet:

Gross income	$105.00
Less yield tax	13.12
	91.88
Less carrying charges, 10 cents per year for 70 years	7.00
	70) 84.88 = net sale value
Average value of annual increment	$ 1.212
	20 (yrs.)
Value of 10-year old stand, Age Class 1	$24.24
Value of Age Class 2	48.48
Value of Age Class 3	72.72

The trouble with this method is that the values for Classes 1 and 2 have no parallel in practice and cannot be justified in theory—it allows nothing for the use of the money invested in carrying charges, and assigns full

TABLE 1

INVESTMENT IN TYPES AND AGE CLASSES

Type	Age Class 1	Age Class 2	Age Class 3
Spruce-hemlock	$2.97	$ 9.50	....
Douglas fir	2.97	9.50	$23.80
Western Yellow Pine			
Washington	3.68	33.80	....
Oregon	5.89	54.08	..

value now to a sum not receivable for many years. Good accounting does not permit this.

Expectation Value. By the use of compound interest and expectation values, the results shown in Table 2 are obtained.

Second-growth western yellow pine presents difficulties on account of its slow growth, the period of immaturity is long, and the ordinary computations give low values. This is modified by the use of the land for grazing, which more or less covers the carrying charges. A low arbitrary value for Age Class 1, say $5.00 per acre for fully-stocked stands, and a considerably higher value for Age Class 2, is suggested. Age Class 2 averages 75 years; exploitation is 25 years distant; 15,000 feet per acre at $3.00 per thousand gives a gross yield of $45.00; less yield tax, about $40.00. This amount discounted 25 years at 4 per cent gives $15.00 per acre. A figure somewhere around here might be adopted.

On unstocked land, damage might be found as follows: unstocked land is presumably restocking and the average restocking period is assumed to be 10 years. The average age of restocking land is 5 years, and carrying charges at 4 per cent interest are 54 cents. Fifty cents per acre for unstocked land which is burned might, for statistical purposes be a reasonable figure for the damage.

The checks on these figures from sales and exchanges are scarce and unsatisfactory. The Forest Service pays from 25 cents per acre for bare land to about $2.25 for well-stocked land. Sales of immature pulpwood for prices varying from $5 to $12 per acre excite no surprise; some stands of pulpwood well along in Class 2 are assessed at $8.00 per acre. Western yellow pine land sells at about $2.00 per acre, for its grazing value. The values may be there, but practically no one wants the young tree growth because at present no one is in a position to handle it as income-producing property. Possible buyers see better investments, or at least quicker returns elsewhere. Owners need the money, and prefer a dime now to a dollar

TABLE 2

VALUES OF REPRODUCTION, PER ACRE

Fully Stocked—Zone 1 (4 per cent Interest)
$3.00 per M for sawlogs—$1.00 per cord for pulp wood.

	Species	Age Class 1 0 to 20 years	Age Class 2 20-40 years	Age Class 3 40-60 years
Block	Spruce-hemlock	$11.88	$25.15	..
A	Douglas fir	7.80	17.10	$37.47
	5 Per Cent Interest and $3.00 for sawlog stumpage			
Block	Spruce-hemlock	7.31	19.40	...
B	Douglas fir	2.88	7.64	20.27
	5 Per Cent Interest and $2.00 for sawlog stumpage			
Block	Spruce-hemlock	7.31	19.40	----
C	Douglas fir	0.21	0.56	1.47
----	4 Per Cent Interest and $2.00 per M			
Block	Pulp	----	----	----
D	Douglas fir	3.49	7.65	16.77

in 50 years. At the same time, values of some sort are there, and those in Block B. with interest computed at 5 per cent are not too far from going prices. A table based on these values might be prepared and used to compute damages.

The headings on the fire report form required to get the information essential for a rough appraisal are as follows:

Type ....Yellow pine, spruce-hemlock, larch-fir, etc. (Each state should make its own list).
Density .... Good, fair, poor, none.
Height .... In feet.
Accessibility .... Good, poor.
Burn .... Heavy, light

As an example of how this might work out, the following instance is used:

Type .... Douglas fir.
Density .... Fair.
Height .... 65 feet.
Accessibility .... Poor.
Burn .... Light.

An average height of 65 feet puts the stand in Age Class 2. Fully stocked, accessible Douglas fir, Age Class 2, 5 per cent interest, stumpage $3.00 per thousand board feet is worth $7.64 per acre, (Block B, Table 2). In an inaccessible location, the stumpage is cut in two; value, $3.82 per acre. As it is half-stocked, the value falls to $1.91 per acre. A light burn kills less than half of it (average loss in light burn, one-fourth of value) giving 48 cents per acre as the damage done.

In practice, it is expected that each state or large unit would adopt its own standard and indices. Computations of damage would of course be made in the office from tables prepared in advance.

No one can appreciate the inadequacy of this system of appraisal more fully than its authors. At the same time, it is an improvement over the methods used in many units, and has some positive advantages. Each element of value can be pinned down, discussed and adjusted to conform to values in other units; most of the needed elements are included; experience so far this year indicates that the field force can furnish the data required in acceptable form. It can easily be revised and expanded to get more precise data, if conditions warrant. Land values are omitted, because cut over land in this region has little or no value at present. Its ultimate value will depend upon the income derived from it, which at present is also little or nothing. What it may be at some future time is pure speculation.

The use of compound interest will be objectionable to some. Without entering that controversy here, it may be said that under the conditions that now govern in these two states, its use cannot be avoided.

A BAD FIRE—A GOOD SALVAGE JOB

By RUSSELL S. BACON

Modoc National Forest, Alturas, Calif.

The utilization of burned timber always presents a difficult problem. When a logging operation is already in effect, salvaging may be feasible. In this article such a salvaging job is described. The author also comments on the handicap of blue stain to more complete utilization.

THE SUGAR HILL fire, one of the most destructive on record in virgin western yellow pine, started adjacent to the Modoc National Forest in northeastern California on the afternoon of July 22, 1929 and crossed the Forest boundary a few minutes later. There was a relative humidity of 7 per cent and a brisk southwest wind, almost a gale, was blowing at the time. All types of ground cover were in an almost explosive condition and in less than three hours the fire had "crowned" and raced seven miles through the finest single body of timber in the Warner Mountain division of the Forest. Over seventy-five per cent of the damaged timber was completely defoliated and killed, indicating the intensity of the burn. Much of the small reproduction and brush was entirely consumed. By evening there was a complete kill over the larger part of an area four miles square. When the conflagration was brought under control the next afternoon practically the entire north end of the Fandango Logging Unit had been destroyed.

At the time of the fire the Crane Creek Lumber Company of Portland, Oregon was operating this unit under contract of sale with the United States Forest Service. The mill was of the modern single-band type. It was situated in the north end of the unit and in almost the exact center of the burn. The yard and box factory were situated on the Southern Pacific Railroad at Willow Ranch, California, and connected with the mill by a six-mile spur. At the time of the fire there was estimated to be in the unit 194 million board feet of western yellow pine, white fir and incense cedar exclusive of fifty million board feet of privately owned stumpage. About five million feet of government timber and a small amount of private stumpage had been cut before the fire. The green timber contract called for a cut of government timber not to exceed an average of ten million feet annually.

With the exception of the sawmill structure the entire plant and everything in the woods belonging to the company went up in flames. It was only by the most heroic effort on the part of company employees that the mill itself was saved. The fire covered approximately eight thousand acres and destroyed or damaged over sixty-two million board feet of timber. The problem immediately presenting itself was the salvaging of as much of the

material as possible before it deteriorated and blue stain set in. This involved the prompt reëstablishment of the plant and camps and a satisfactory working agreement between the Forest Service and the operator. Before the fire was two days old new logging camp equipment and supplies had been shipped from Portland. An administrative use permit was issued to the company by the Forest Service pending the consummation of a formal agreement.

A re-appraisal of the burned area was made by Forest Service officers shortly after the fire and new contract conditions were drawn up. A salvage agreement was subsequently executed with the company eliminating the burned-over area from the green timber contract. This involved a reduction in price and made the removal of white fir and incense cedar optional. The contract had several clauses that were unusual in Forest Service agreements. The d.b.h. limit was raised from twelve to twenty inches and the top diameter limit from ten to sixteen inches. The diameter limits above mentioned were closely adhered to during the life of this modified agreement. The falling of snags was not required. Brush piling was also not required except where trees bore green needles or where, in the judgment of the forest officer in charge, it was necessary to protect adjacent green timber. The limbs were lopped from all tops so they would come in contact with the ground and invite early decay. Naturally no logging restrictions were placed on the operator by the government for the area inside the heavy burn. It was stipulated that fire-killed material was to be removed first.

After the fire the company officers put on a double shift in the mill as soon as they were reorganized. By doing this they increased their daily cut to 160,000 feet, board measure, daily. Logging was by tractor and truck with the maximum haul not over three miles. With the exception of a six-weeks shut-down on account of inclement weather they continued this double shift until the fire-killed timber was milled. The company has salvaged slightly over thirty-six million board feet. Twelve million board feet of material not salvaged consisted of white fir and incense cedar, the removal of which was made optional in the salvage contract. The remainder of the sixty-two million board feet consisted mostly of inaccessible western yellow pine and material below contract specifications in size. In addition to the salvage operations by the Crane Creek Lumber Company, local farmers and woodcutters were given special rates on cordwood, poles and posts and a considerable amount of such material was salvaged from the burned area during late 1929 and 1930.

Early in the following spring some blue stain was encountered and the company feared that an unusual amount of degrade would result from this in yard seasoning. Through coöperation with the office of Forest Pathology of the Bureau of Plant Industry test piles were set up in the company's lumber yard. The limits of the stained area were outlined with crayon on each board before it left the

mill. After seasoning it was found that no development of stain had taken place in the piles outside of an occasional slight extension of stained areas already present in the stock. The extensions noted did not amount to more than one-half inch at the maximum and for most of the stained spots marked when the pile was erected no extension whatever could be noted. All boards that went into the pile bright came out in the same manner. The results show definitely that, with the unusually good drying conditions prevailing in this region during the summer months, blue stain should not be an appreciable factor during yard seasoning. This seems true regardless of whether the lumber comes from green or from fire-killed trees, providing it is properly piled for seasoning. Owing to the lack of stain development during the test no evidence was secured on the question of whether lumber from heavily burned trees will stain more readily than that from green trees. The result of the above test should allow us to be more positive in our statements concerning the development of blue stain.

The salvage of fire-killed material was completed late in August 1930, or over thirteen months after the fire occurred. At this time there began to appear a notable increase in the amount of blue stain in trees of merchantable diameter but even this degrade was found in less than 5 per cent of the logs within the contract diameter limits. It was with much satisfaction that there was found to be such a long period following the fire before degrade from blue stain presented a serious problem.

The Bureau of Entomology has laid out several sample plots within the fire area to determine the loss from insects. The studies have not progressed far enough to draw conclusions, but present conditions indicate that the losses will be nominal.

Planting has been an important cog in the machine of rehabilitating the Sugar Hill fire area. It had been planned to start planting in the fall of 1929 but adverse moisture conditions prevented. The first plantations were set out in March 1930. Eighty per cent of 20,000 seedlings set out at that time survived the unusually dry 1930 season. To date approximately 125 acres have been planted to western yellow pine and Jeffrey pine. As soon as additional planting stock becomes available the annual planting acreage will be enlarged to enable the young trees to get as much of a start on the various brush species as possible. Our first investigations of the plantations show that Jeffrey pine is the best survivor.

The Fandango Logging Unit comprises part of the Pit River-Goose Lake Valley Working Circle. This working circle was put under a plan of timber management by the Forest Service in 1925. The allowed annual cut for the entire working circle is 15,600,000 feet, board measure. The Crane Creek Lumber Company contract calls for a cut of approximately 10,000,000 feet, board measure, annually. The balance of the cut is taken up by three small circular mills.

The Sugar Hill fire will affect the management plan in several respects. The period of logging operations in the Fandango Unit will be reduced several years. There will be a reduction of the yield in the second cutting cycle by the quantity which would have been cut on the area of the burn if this fire had not occurred. Roughly speaking this reduction will amount to about 60,000,000 feet, board measure. It is not planned to modify the allowable rate of cutting until more reliable yield data has been compiled based upon cruises of cut-over areas within the working circle and more comprehensive growth data. If the planting program now being carried on is successful this burned-over area will be ready for marketing in the first cutting cycle of the next rotation.

The above gives the high points of what has happened in the Fandango Logging Unit since that eventful day in July 1929. Fifty-nine per cent of all material over twelve inches d.b.h. and ten inches top diameter, killed or fire damaged, has been salvaged. Seventy-three per cent of the western yellow pine was utilized. Foresters in general will agree that this is a salvage job well done.

The Sugar Hill fire, occurring as it did in the heart of a body of virgin timber of unusually high economic value was, without doubt, a local calamity. There is, however, some consolation in the fact that this area will prove an excellent outdoor laboratory to test our ideas of planting, blue stain development and insect losses due to fire.

THE FOREST SURVEY IN THE BOTTOMLAND HARDWOODS OF THE MISSISSIPPI DELTA[1]

By G. H. LENTZ

Silviculturist, Southern Forest Experiment Station

A current major project of interest to foresters and lumbermen, especially those concerned with the economics of the forest industries, is the forest survey now being pushed so energetically by the Forest Service in several regions. The hardwoods have always received less attention than the conifers. It is gratifying, therefore, that this important group is to be included so early. Mr. Lentz describes the problems peculiar to the hardwood survey and offers classifications of sites and types. Mr. Putnam's comments which follow the principal paper enlarge upon and further clarify some of Mr. Lentz' statements.

AT VARIOUS TIMES estimates, based on the best available data, have been made regarding the forest resources of the United States. The results of these estimates have appeared in several forms, the most familiar being the so-called Capper Report or Senate Resolution 311, issued in June, 1920, and *Timber: Mine or Crop?*", issued by the Forest Service in 1922. Some of the information given out in these publications was based on the data which was admitted to be very scanty but it was the best to be had at the time. For years, foresters and forest extension men have quoted the following figures: "81,000,000 acres of waste and idle land," and "we are cutting our forests between four and five times as fast as they are growing." The figure of 81,000,000 acres never changed much from year to year even though it was also stated that we were adding to the waste and idle land at the rate of 4,000,000 acres per year.

The Capper Report and *Timber: Mine or Crop?*" no doubt served their purpose—but they are now out-of-date and the Timber Conservation Board recently appointed by President Hoover is asking for a revision of the figures given in the Capper Report. Another extensive estimate or broad guess is to be made, for, with a few minor exceptions, we know no more about our forest resources today than we did ten years ago.

Other countries have been faced with the same problem, a lack of information concerning their forest resources, and, after years of planning, forest surveys were made in Finland, Norway and Sweden. Norway relied primarily on a compilation method to bring together all the information desired, while in Finland and Sweden the government forest officials decided upon a field survey to gather the required data. The reports issued by Dr. Yrjo Ilvessalo concerning the Finnish Survey and those published by Dr. Henrik Hesselman on the results obtained in Sweden have been carefully studied by

[1] Presented at the meeting of the Gulf States Section, Society of American Foresters, New Orleans, La., March 14, 1931.

foresters and forest economists of other countries and their working plans have served as a guide in the preparation of plans in other countries.

No extensive or nation-wide surveys or inventories of forest resources had been undertaken in this country prior to the inauguration of the present work, but several states on their own initiative had carried on economic or land utilization surveys. In 1922, Michigan undertook an economic survey. Maryland, through the State Forester's office, has completed an inventory of her woodlands and on county maps shows their location. Wisconsin and Minnesota are following Michigan's lead. Massachusetts has completed a forest survey. Vermont is carrying on an Economic Survey and Governor Roosevelt of New York State has asked the legislature to make an appropriation of some $750,000 for a land-use survey in the state. Other states have programs similar to those listed above.

After years of agitation on the part of the forestry leaders of the country, cognizance was finally taken of the need of a nation-wide forest survey and with the passage of the McSweeney-McNary Act, such a survey was authorized. This authorization was summarized and the scope of the work explained by C. M. Granger, Director of the Survey, in a pamphlet entitled: *Facts Concerning the Forest Survey, Its Scope and Value.* The following is quoted from this publication:

"*Authorization*

Authorized by Section 9, of the McSweeney-McNary Forest Research Act of 1928, which authorizes and directs the Secretary of Agriculture to coöperate with states and private agencies in making a comprehensive survey of the present and prospective requirements for timber and other forest products in the United States, and of timber supplies, including a determination of the present and potential productivity of forest land therein, and of such other facts as may be necessary in the determination of ways and means to balance the timber budget of the United States. Authorized annually not exceeding $250,000, total not exceeding $3,000,000.

Scope

The Forest Survey is designed to secure the first complete and accurate picture ever had of the forest situation and forest needs of the Nation. It will determine

1. The area of each type of forest cover, the stand of timber in board feet and cubic feet by species, and the regrowth conditions on cut-over and burned forest lands.
2. Rate of forest depletion by cutting, fire, insects, disease and any other important factors.
3. The rate of growth in existing forests and on reforesting areas, and probable future timber yields from the forest lands of the nation under present conditions of fire protection and forestry and under adequate fire protection and systematic forest management.
4. Present national requirements in forest products and probable future trends in needs and character of use of forest products."

This survey will probably be one of the most comprehensive economic studies ever made in the United States. It can be readily understood from the above quotation that the problem of taking a forest inventory is only one phase of the whole problem, it is really the beginning point, like stock taking is to an industry. The survey will not be complete until accurate figures on forest growth on the one hand and forest depletion through cut-

ting, fire, insect and fungi, etc., on the other hand have been obtained. The increased or decreased demands for forest products, such as lumber, ties, posts, firewood, pulpwood, etc., must also be considered so that a real balance can be struck. The reversion of farm lands to forest land and the clearing of present forest lands for agricultural use must also be considered, and in determining the future trends of land use the agricultural economist may have to be called in.

On the Pacific Coast, in the Douglas fir region of Washington and Oregon, the economic condition of the forest industries is in a particularly acute state. With 51 per cent or more of the remaining saw timber of the United States, located in the three westernmost states, it was particularly fitting that the first work of the Forest Survey should begin there and this work has been carried on with an increasing force since July, 1929. A compilation method has been largely used in the Douglas fir region and the fact that nearly all of the extensive timber areas have been carefully cruised and the further fact that these cruises are to a similar standard and have been made available to the Forest Survey, makes it possible to use such a method. Plans are under way to check the accuracy of this compilation work by means of a strip survey of a county which has already been covered by compiling existing data.

The bottomland hardwood area of the Mississippi Delta is the second in which the survey is being conducted. In this region probably less is known concerning the timber conditions, nature of the cut-over areas, etc., than in any other important timber region in the United States.

The conflicting and widely differing estimates on the area of virgin and second-growth timber in the hardwood bottomlands, and the almost absolute lack of any reliable growth figures for the timbered areas lying within the Delta, made it particularly desirable that the Forest Survey should choose this as the second area to be studied. Funds for this hardwood survey were made available in July 1930 and the appropriation for this year is $25,000. An appropriation of $40,000 has been made to inaugurate the pine survey and it is planned to start this work July 1. But it is with the hardwood survey that this paper aims to deal.

The writer was chosen to direct the hardwood survey which is one of the major projects of the Southern Forest Experiment Station and, in order to become acquainted with what had already been done, spent most of December on the West Coast conferring with the Director of the Pacific Northwest Survey. Upon his return, Director Granger and J. W. Girard came to New Orleans to help formulate a working plan for the survey in the Delta. After several trips into the bottoms, and numerous conferences at New Orleans in which all of the men at the Southern Station, familiar with hardwoods took part, a working plan has been evolved.

When it is considered that this working plan is designed to apply to 25,000,000 acres, the estimated area of

the hardwood bottomland area of Louisiana, Mississippi, Arkansas, and Missouri, it will be realized that such a plan has to be quite comprehensive. The following will be a brief discussion of the main points of the working plan.

After a study of the compilation method and its application to the Forest Survey in the Douglas fir region, it was decided that such a procedure would be impracticable in the hardwoods due to the following reasons:

1. There are over 40 different species of commercial importance to be considered in the Delta compared to five or six in the Douglas fir region.

2. Timber estimates made by numerous agencies have not been on a comparable basis, varying merchantable limits have been used and in some cases certain undesirable species from the standpoint of the timber buyer have been entirely ignored.

3. No generally accepted forest type classification exists as yet for the southern hardwoods. The Survey has set up a list of types but subsequent field work may prove them undesirable.

In view of the above, it has been decided to obtain the necessary data by putting survey crews into the field and running strip lines at certain intervals which will be determined by statistical analysis of preliminary work to be carried on early this spring.

Once this interval had been determined, the strip line locations will be drawn in on a base map and these lines will cover each state from the levees to the boundaries of the hardwood areas. Sample plots of one-quarter-acre or smaller will be taken every 10 or every 20 chains and the detailed data collected for each sample plot will provide the information on which the final timber estimate, estimate of growth, extent of fire damage, etc., will be based. Each sample plot will have a site, type, and condition designation but no attempt will be made to construct a type map. The changes from one forest type to another are so gradual that in most cases no definite type boundaries can be delineated. The percentage figures on the occurrence of each type will be obtained from the sample plot sheets. In place of a map, a line record or strip tally will be kept showing only the linear distance of each class of land crossed by the strip line. On this strip tally, two general classes of areas will be recorded, forest areas and non-forest areas.

The forest areas will be divided on a basis of site and condition. Five broad sites will be recognized, namely: (1) Ridge, (2) Flat, (3) Swamp, (4) Batture and, (5) Upland. These sites may be defined as follows:

1. *Ridge.* The ridge site is that found on the higher, better-drained portions of the bottom where water ordinarily stands only a short time after a rain or occasional overflow. Ridges may be narrow—only 15 to 20 feet wide—or they may be more in the nature of a plateau covering extensive areas. Red gum stands are an indicator of ridge land or ridge soil and drainage con-

ditions and areas where it occurs will be classed as ridge; cow oak is also an indicator. (Red gum trees *may* be found in flat land where soil and drainage conditions are poor.) The ridge soils are the better-drained clays, silty clay loam, the silt loams and the sandy loams. They are most commonly found along the river and bayou fronts.

2. *Flats.* Extensive areas with poor drainage, heavy clay soils and relatively poor timber growth. Overcup oak, water hickory, and persimmon, are the chief indicator species on the flats. Growth is slow, the volume per acre is low and reproduction is either entirely absent or very sparse. Water stands on the flats for a considerable period after each rain or overflow due to the lack of sufficient slope for surface drainage and a heavy clay soil which does not permit percolation. The flats are often found at considerable distances from the rivers and bayous. These areas are not suitable for agriculture even if drained.

3. *Swamps.* Areas usually under water but having tree growth present will be classed as swamp. Cypress and tupelo brakes are the outstanding examples of swamps and these two species are the chief indicators of the swamp type. The swamp areas are particularly common in the southern part of Louisiana where they gradually merge into the untimbered tidal marshes. None of the swamp lands are of agricultural value.

4. *Batture.* Lands lying between the river and the levee. On these areas a silty loam, sandy loam or sand occurs, the areas are subject to frequent or almost annual overflow, and growing conditions are different than on the other sites.

5. *Uplands.* Certain areas lying within the boundaries of the bottomlands are remnants of an older geologic formation. These areas such as portions of Macon and Crowley's Ridge, contain a mixture of pine and upland hardwoods and are distinct from the true bottoms.

The condition of each forest area along the line will be designated as: (1) Virgin; (2) Culled; (3) Cut Over, Restocking; (4) Cut Over not Restocking; (5) Ruined by Cutting, Fire and Grazing; and (6) Old Field. Each of these conditions are defined:

1—V. *Virgin.* Stands with no cutting or where cutting for sawmill material or staves has not taken out any *appreciable* portion of the original stand. White oak stave cutters have cut oak from many stands but where the crown canopy is still largely intact, the stand can be considered as virgin. The dominant trees in virgin stands are 100 years or more old.

2—C. *Culled.* Stands from which choice trees of certain species or of all species have been cut, leaving a good stand of trees above 12 inches d.b.h. Stands managed under selective logging would be classed as *culled.*

3—Co R. *Cut-Over, Restocking.* Where practically all the merchantable trees of the more valuable species have recently been cut for saw logs, staves, etc., leaving no trees over 12 inches d.b.h. except inferior species or undesirable individuals of the better species.

A sufficient stand of trees under 12 inches occurs to insure another crop, but only after a long period of time.

4—Co. N. *Cut-Over, not restocking.* Where all merchantable trees have been cut, leaving no trees which will produce another crop. In the *not-restocking* areas no seedlings have come in to restock the cut-over area.

5—R. *Ruined by Cutting, Fire and Grazing.* Due to clear cutting followed by repeated burning and heavy grazing, certain areas are covered by vines, honeysuckle, poison ivy, cat briar, and the like.

6—OF. *Old Field.* Stands usually under 70 years of age which have come in on land once in cultivation. Such stands will usually be fairly even-aged—they have had fair growth during the early stages at least, due to the better condition of the soil. Old fields are the next stage following the *abandoned* class under non-forest lands. If an abandoned field is more than 10 per cent stocked with trees five years and older, it will be classed as an *Old Field.*

The non-forest areas will be listed by number on the strip tally, but no detailed record of the non-forest areas will be made on the sample plots where they fall in non-forested areas.

For the agricultural area and for the forest areas, soil and drainage conditions will also be recorded. The area of abandoned farm land will give a clue to the rate at which farm land is likely to revert to forest, and the deadenings will give a clue on the other hand to the rate of clearing of forest land for agricultural use. A statement recently made by one of the field men of the Bureau of Chemistry and Soils indicates that less than one per cent of the present forested portion of the bottomlands of Louisiana lying south of the Red River would be converted to farm land within the next 20 to 40 years, and that probably not over five per cent of the area north of the Red River would be needed for farming purposes in the same period of time.

The foresters at the Southern Forest Experiment Station who have been working in the bottomland hardwoods have agreed that rather broad forest types or forest associations might be recognized. These types may not be the ones finally adopted by the Type Committee of the Society of American Foresters of which Professor R. C. Hawley of the Yale Forest School is chairman, and of which Dr. L. J. Pessin is local chairman, but they are at least workable units and will serve until more time and study can be devoted to the problem of hardwood types. These types in general follow those described by the writer in the May, 1929 issue of the JOURNAL OF FORESTRY, but in order to conform with the type classification of the Society, the present types are based almost entirely on the forest associations disregarding the changes in growth and yields due to a change in site conditions.

Twelve forest types have been set up and are described briefly as follows:

1. *Cypress-Tupelo.* CT. Where cypress and tupelo form 60 per cent or more

of the stand. This type is usually found on the *swamp* sites and may occur also on some of the wetter *flats.* Red maple is a common associate.

2. *Cypress-Hardwood.* CH. This association is found on areas where water stands at frequent intervals and which can be classed as *flats* rather than swamps. On such areas tupelo is replaced by overcup oak, green ash, red gum, pin oak, red maple. The soil may be either a clay or a clay loam. The cypress found in this type is ordinarily without knees or with knees of low height.

3. *Red gum.* RG. Where red gum makes up 60 per cent or more by volume of the merchantable stand or in a young stand 40 per cent of the dominant and codominant trees, the stand will be classed as a red gum type. The red gum type will be found primarily on the ridge sites, either pure or associated with red oak (*Q. rubra*), cow oak, (*Q. prinus*), elm and ash. On the flats where it occurs rarely, it will be associated with elm, pecan, water hickory, green ash, and others.

4. *Red Gum—Clay Flat Oaks.* RG-CFO. On the flats, the red gum type often gives way to a mixture of gum and oak where the gum and oak make up 60 per cent or more of the stand. The oaks are water oak (*Q. nigra*), willow oak, (*Q. phellos*), water oak, (*Q. obtusa*), Red River oak (*Q. nuttalii*) and pin oak (*Q. palustris*). overcup oak (*Q. lyrata*) is the only representative of the white oak group found in this type.

5. *Red Gum—Loamy Ridge Oaks.* RG-LRO. This association is found on the ridge sites where the red gum may have been cut out to some extent. The white oaks found are cow oak. (*Q. prinus*), post oak (*Q. stellata*) and on the highest ridge land forked-leaf white oak (*Q. alba*) may be found. The red oaks are southern red (*Q. rubra*), cherry bark (*Q. ruba pagodaefolia*), Shumard oak (*Q. shumardii*) with black oak (*Q. velutina*) on the same sites as the forked-leaf white oak. White elm, ash, hackberry, are also found as associated species.

6. *Bottomland Oaks.* Bt O. On flats and low ridges a mixture of red, water and white oaks may be found with six or seven species of oak being represented. Ash, elm, persimmon, pecan and hackberry are associates. The oak would make up 60 per cent or more of the stand.

7. *Oak-Hickory.* OH. This association is found on the higher ridges and on the uplands, above all overflow. Such areas occur along Macon Ridge, Crowley's Ridge, etc. *Quercus alba* and *Quercus prinus* are the chief white oaks found in this type with some *Quercus rubra.* The hickories are *H. alba, H. glabra,* and *H. obtusa.*

8. *Cottonwood-Willow.* CW. A large portion of the cottonwood and willow stands are found along the river margins, on the batture lands, and on sandy to sandy-loam soils in old fields or outwash plains. Either species may be found pure. Cottonwood often has an understory of red gum. Willow is found along the river's edge with cot-

tonwood on the slightly higher portion of the river bank.

9. *Hackberry-Elm.* HE. Many of the cut over areas on the flats have a residual stand of hackberry and elm making up 60 per cent or more of the basal area and with numerous other hardwoods, but in minor quantities.

10. *Oak-Elm.* OE. This type is very widely distributed throughout the Delta and is most commonly found on sites once forested with the bottomland oaks type where heavy cuttings have resulted in a large admixture of elms. Willow, water (*Q. nigra*), overcup, Shumard, and Red River oak are associated with white, winged or cedar elm. A single species or sometimes two species of elm may be found in this type.

11. *Overcup Oak-Pecan.* OP. Found on the poorly drained flats and edges of swamps. Pecan includes bitter pecan (*H. texana*) and the more commonly found water hickory, (*H. aquatica*) called and marketed as pecan by the lumberman. The oak and pecan are often the only trees reaching merchantable size and they usually are very slow growing. Elm, persimmon and water oak (*Q. nigra*) as well as planer tree and privet are common associates.

12. *Pine-Hardwoods.* PH. On the highest ridges and remnants of ridgeland, loblolly or shortleaf pine may be associated with the upland oaks, hickory, elm, etc. If the pine makes up 40 per cent or more of the merchantable volume the type will be called pine-hardwoods, and if less than that amount of pine is found, the stand, will be classed as one of the hardwood ridge types.

Probably no other forest region of the United States has a more diversified representation of tree species as is indicated by the incomplete list of 48 species in Table 1.

TABLE 1

PARTIAL LIST OF TREE SPECIES IN THE MISSISSIPPI DELTA REGIONS

Common Name	Abbreviation	Scientific Name
Ash, green	G A	*Fraxinus pennsylvanica lanceolata*
Ash, white	W A	*Fraxinus americana*
Basswood	Ba	*Tilia glabra*
Beech	Be	*Fagus grandifolia*
Cottonwood	Co	*Populus deltoides virginiana*
Cypress, live	Cy L	*Taxodium distichum*
Cypress, dead or down	Cy D	
Elm, cedar or rock	CE	*Ulmus crassifolia*
Elm, white or red	WE	*Ulmus americana*
Elm, winged		*Ulmus alata*
Gum, black	BG	*Nyssa sylvatica*
Gum, red or sweet	RG	*Liquidambar styraciflua*

Common Name	Abbreviation	Scientific Name
Gum, tupelo	T	*Nyssa aquatica*
Hackberry	Ha	*Celtis laevigata*
Hickory (except water hickory)	Hi	*Hicoria* spp. (any upland species not listed under pecan)
Locust, honey	L	*Gleditsia triacanthos*
Locust, water		*Gleditsia aquatica*
Magnolia	Mg	*Magnolia grandiflora*
Maple, red	Ma	*Acer rubrum*
Maple, silver		*Acer saccharinum*
Oak, black	Bl O	*Quercus velutina*
Oak, burr	Br O	*Quercus macrocarpa*
Oak, cherry-bark	Cb O	*Quercus rubra pagodaefolia* and *rubra leucophylla*
Oak, chinquapin	Cq O	*Quercus muhlenbergii*
Oak, cow	Cw O	*Quercus prinus*
Oak, laurel	La O	*Quercus laurifolia*
Oak, live	Li O	*Quercus virginiana*
Oak, lowland black or water	LB O	*Quercus nigra*
Oak, Nuttal's or Red River	Rr O	*Quercus nuttallii*
Oaks, overcup	OO	*Quercus lyrata*
Oak, pin	Pi O	*Quercus palustris*
Oak, post	Po O	*Quercus stellata*
Oak, shingle	Sg O	*Quercus imbricaria*
Oak, Shumard red	Sh O	*Quercus shumardii* (and var. *schneckii*)
Oak, southern red	SR O	*Quercus rubra*
Oak, water	Wt O	*Quercus obtusa*
Oak, willow	Wl O	*Quercus phellos*
Pecan, bitter (including water hickory)	P	*Hicoria texana, H. aquatica*
Pecan, sweet		*Hicoria pecan*
Pine, loblolly	LP	*Pinus taeda*
Pine, shortleaf	SP	*Pinus echinata*
Poplar, yellow	YP	*Liriodendron tulipifera*
Sycamore	S	*Platanus occidentalis*
Walnut, black	BW	*Juglans nigra*
Willow	W	*Salix* spp.
Others	Oth	
Species not merchantable as saw logs but used for special products		
Dogwood	D	*Cornus florida*
Holly	Hl	*Ilex opaca*
Persimmon	Ps	*Diospyros virginiana*

From the description of the procedure in getting the data required for the hardwood survey, one might get an idea of a rather involved process, but the mechanical phase of collecting and recording the data is by no

means the most difficult problem to be overcome. In order to get a true statistical picture of conditions, it is going to be necessary to run the strip lines at right angles to the prevailing drainage, that means in an east and west direction. Anyone even in the slightest degree familiar with the complicated drainage systems of the Delta, knows that the ramifying bayous, sloughs and lakes, present a real difficulty in getting across the country. The survey crews will have to wade many of the shallow cypress brakes, sloughs, and other shallow bodies of water. They will have to swim many of the narrower bayous and in other cases portable boats may have to be used. If it were not for the water hazards, the field work might best be done in the fall and winter, but at that time the waterways may be the fullest and the water surely none too warm. We do not have dry years like the past one very often, and conditions this past fall and late summer were ideal from a timber cruising point of view. Much of the field work may have to be done in the summer and early fall, and plans will have to be flexible so that the higher, drier portions of the region can be covered at a time when the water is too deep for efficient cruising work to be done. It may even be necessary to arrange for an interchange of crews with the pine survey so that the crews can work the hardwoods in the drier and warmer portion of the year and put in their time on the pine survey during the cold and rainy spells.

The absence of passable roads in many portions of the Delta, also offers a difficulty, but not as serious as the one just mentioned. In certain areas in Louisiana as in the southern end of Concordia Parish for example, no roads exist and it will be a problem to get the crews to and from work with the least amount of lost time and physical effort. Arrangements may have to be made in some instances so that the crews can camp out for two or three nights, and if that has to be done, an additional man to act as "toter" may have to be employed.

With the completion of the aerial survey and mapping program of the War Department, all of the alluvial lands in the Mississippi will have been mapped to a scale of one inch to the mile. The District Engineer at Vicksburg, has stated that all the quadrangle maps for his district will be available by July 1, 1931. These maps are as accurate as any that can be made and will prove of inestimable value to the Survey. With their use the party leader can tell in advance what obstacles he will encounter and can make his plans accordingly. As the maps show the general location of the timbered areas they will prove of inestimable value in checking the strip data.

It may take from three to four years to complete the inventory phase of the hardwood survey, but when it is completed we will have the first accurate data on the amount, the occurrence, the rate of growth, and the rate of depletion of the bottomland hardwoods, and there will no longer be the need of extensive estimates based on inadequate data.

COMMENTS ON MR. LENTZ' PAPER ON THE FOREST SURVEY[1]

By J. A. PUTNAM

Southern Forest Experiment Station

MR. LENTZ has taken pains to indicate that the essential difference between our *present* information on our forest resources and their consumption *and* the information which the *Survey* is designed to procure is the difference between a guess and an invoice. He also shows that, in determining the present and probable future needs, a classification of the kinds of product will be used rather than mere gross volume. However, I feel that this point might well be more fully stressed and another point brought out which it implies. That is, that in determining the volume of our present resources and the probable growth and depletion, provision must be and is made for a classification as to quality or suitability for use in the principal classes of products.

As elementary and obvious as this principal is when stated, I am led to state it and try to stress it because it has seemed to me that, in arriving at many of our present grand guesses or estimates and particularly in using them as generalities, we have almost as a rule lost sight of this principal and generally failed to state what we were actually talking about. In fact, we have more often than not talked one thing or everything as a *resource* and then some specific product as the corresponding consumption.

Since I am primarily experienced and interested in hardwoods, and since they illustrate the application of this principal in the extreme due to the great variety of common products and the sharp limitations upon quality and kind of material suitable for each, I was greatly impressed by the effectiveness as an illustration of this of figures given in a recent bulletin of the New Orleans Chamber of Commerce.

It was stated that we have a national resource of hardwood timber slightly in excess of 450 billion board feet and the only consumption or depletion stated against this grand total was the lumber cut of practically 7 billion feet, the only commodity consumption figure commonly quoted in board feet. Nothing was said about either depletion through natural causes or of growth but, assuming that these balance we have an indicated hardwood supply on hand for about a 65-year run for the lumber mills at the present rate of consumption and standard of utilization. We know this is impossible. In fact, in the whole discussion there is no logical basis for a satisfying comparison of resources and consumption even if it were known what to do about natural depletion and growth.

No doubt the grand total of 450 odd billion feet was intended to represent our total hardwood resource in mere

[1] Presented at the meeting of the Gulf States Section of the Society of American Foresters, at New Orleans, La., March 14, 1931.

sound wood, which is an extremely different matter from hardwood saw timber as the expression of the figure in board feet tends to imply. Against such a total then, the *total* hardwood consumption of the United States must be charged and the lumber mill consumption makes barely half. Cross ties make two billion feet alone, and in addition cooperage material, pulpwood, poles and piling, and others must be added which may bring the total *commercial* consumption up to about the equivalent of 12 billion feet. Finally, the local consumption for posts and fuel must be added and very likely a grand total, the equivalent of 15 billion feet per year would appear; hardly half of which would ordinarily be recorded as board feet if recorded at all.

However, this brings the relation of the present supply, based on the present rate and standard of utilization and disregarding growth, into a reasonable relation with consumption indicating 30 years' supply on hand in the aggregate though this may be much too short a period for some types of material such as fuel, and much too long for others such as lumber mill timber which makes half the cut but certainly a much smaller part of the stands.

The indications seem to be that the grand total was probably a very good guess but rather useless at that for lack of a basis of interpretation; in fact, it is quite misleading. I must add that I do not vouch for any of my figures, having merely picked up approximations for purpose of illustration.

The moral of all of this seems to be that it is not the size of the wood pile that counts but what you can do with it, and it should be our purpose to keep this clear.

With reference to Mr. Lentz' remark that it will be necessary to appraise the direction and strength of the agricultural trend, I wish to remind you of the existence, undisputed until recent years, of two notable fallacies regarding this region which can hardly be too often harped upon because they long constituted the bulk of the thought of foresters upon this region and were to a great extent, possibly, the cause of the general apathy regarding the present source of half our hardwood supply.

The first was the idea that this was one region in which the fire menace was inconsiderable because of the generally moist conditions, whereas actually every year small spot fires take their toll and, in dry years such as 1924 and 1930, fires become general and intense, causing directly as much loss as fires in any region, excluding crown fires, and indirectly, including the loss through introduction of fungi, they cause a total damage over a long period equal to that in most any fire-ravaged region. The proper allowance for fire losses will be an important and difficult consideration in the Survey.

The other fallacy has been that the well known fertility of the area precluded any consideration of it as a forest region indefinitely. However, in late years the much cussed and discussed general agricultural situation

has made it apparent that mere fertility cannot induce the improvement of any extensive territory for agriculture and that the order of things must be towards retrenchment in all regions. In this particular region there has been a small net decrease in improved area since 1920 and about two-thirds of the area is still unimproved.

I feel that several factors combine to make the general agricultural situation apply with extra force in this territory. In the first place, the elaborate leveeing, draining, and clearing absolutely essential for the development of most of this land has run taxes up out of proportion to the intrinsic value of the land in most sections, and the costs exceeding the carrying powers of private interests in innumerable instances. In the second place this is a one crop and cash crop region, based on cotton, in the throes of readjusting its crop budget under pressure of the low cost competition from the southwest and aggravated by the boll weevil which is especially pernicious in the bottoms. This readjustment will be especially difficult due to the lack of interest of capital in the large operator who dominates the scene, the remoteness of markets for and competition in most of the alternative crops, and the lack of an intelligent, independent, self-sustaining small farmer element. I am quite intrenched in the belief that the forest area of this region will be of primary importance as forest far into the indefinite future.[2]

It may be worth calling attention to the fact that this very large block or compact unit to which the present Survey project applies actually comprises but probably 65 to 70 per cent of the total area of this sub-region or big general alluvial lands type within the Southern forest region. The bottoms of a number of principal tributaries to the Mississippi System have been excluded and there are a few isolated major alluvial areas, all of which will have to be included under the Survey of the general Southern region when it is inaugurated but to which our experience will apply if not our findings in the present project.

Regarding the sites, it is notable that distinct ridges are in fact almost invariably stream margin phenomena or indicate the former location of a stream, whereas genuine flats are typically of interstream occurrence; in this respect topography is upside down in the bottoms. A better class of flat is common than that suggested by Mr. Lentz' description which is also very extensive. A fairly satisfactory class of timber may be found on this better class of flat dominated by *Q. nuttallii* or swamp red oak.

The more extensive of the plateau-like ridges or general elevations mentioned are in most cases second bottom areas or portions of old terraces as yet undissected by erosion. It should be understood that these site conditions are often not clean cut and distinct, for example, one of the plateau-like ridges may easily be mistaken for a

[2] The reader is referred also to the editorial "Neglecting Our Hardwoods" in the May, 1929 issue of this Journal. *Ed.*

flat except for the soil and timber and an extreme example of a clay flat may be practically a hardwood swamp. Also, many of the higher second bottoms and lower uplands may be almost indistinguishable.

In considering types I think it well to point out that there are actually two phases of the gum type. The one which Mr. Lentz stresses is the loamy ridge phase and is always quite mixed with the ridge species, which he names. The other phase is typical of clay or silty clay ridges in the first bottoms and is more likely to run pure than the other phase and, when mixed, its associates are willow oak, and swamp red oak as well as the species Mr. Lentz names in association with the gum type on flats. In fact, the clay ridge and flat occurrences are, in a practical silvical sense, the same thing.

Considering the two phases of the gum type based on site or oak associates, which is the same, the two following gum-oak types will be seen to be derived from them in the event of a low proportion of gum in either respective phase. *Q. nigra* is even more important on loamy ridges than on clay land.

In the overcup oak-pecan type I feel that *Q. nigra* is not representative as an associate but that green ash, *Q. nuttallii*, and cypress are important.

Please note that red elm does not signify slippery elm, this is a local name for flat-land white elm.

A NATIONAL FOREST AS A LOCAL ECONOMIC FACTOR[1]

By L. L. BISHOP

Forest Supervisor, Allegheny National Forest

Just how does a proposed or newly-created national forest affect nearby local communities? The author answers this question for conditions prevailing in the national forest "purchase" areas in the East.

IN VARIOUS STATES of the Union decisions are being made, and in the future will be made, as to whether or not new national forests shall be established or existing national forest units shall be extended. Those charged with the responsibility of making such decisions should weigh carefully the results that may be expected to attend. It is proposed in this paper to list the principal advantages and disadvantages of the carrying out of a national forest project. The question of national forest extension is most pertinent in the East at this time, and this paper is based largely upon Eastern or acquisition national forest conditions. Acquisition national forests are such forests as have been built up of areas of land acquired by the federal government for that purpose. Such forests are confined largely to the New England, eastern and southern states.

Although this paper deals specifically with national forests, it may be noted that with but few exceptions the results of managing a forest area on a sustained yield basis are quite the same, be that area owned by the federal government, a state, county, municipality, corporation or an individual.

The scope of this paper is limited to the more obvious and tangible economic influences of national forests on the local region. By local region is meant the area inside the national forest boundary and the territory within a few miles thereof.

It is proposed to here catalogue the various influences, (space does not permit of their being more than very briefly discussed) to show how certain unfavorable influences may be removed or mitigated, and to outline a policy as to national forest extension in the East. The influences are to be grouped under several major subdivisions. In the main the headings used are Forest Service activity headings.

Acquisition

Once the location of a proposed national forest has been determined, the various steps looking toward the purchase of the land are inaugurated; offers to sell areas to the government are solicited; areas that appear to be reasonably priced are examined, appraised and reported upon; options are

[1] Presented at the meeting of the Allegheny Section of the Society of American Foresters, at Harrisburg, Pa., February 27-28, 1931.

authorized at prices which appear to conform to the policy laid down by the National Forest Reservation Commission; and upon authorization of purchase by the Commission, in certain instances prior to such authorization, the survey of lands is taken up. Concurrently with the survey or after the description is prepared a very thorough title examination is made. Once the title is reported as entirely good and the report is approved by the Attorney General, a deed is executed by the vendors, place of record in the local court house and a voucher issued in the amount of the total purchase price. The land then becomes a part of the national forest.

Through this acquisition procedure certain benefits accrue to the local region. The examination, survey and title work bring to the region trained specialists in each activity. They may or may not be married men. In either event they add to the local business through the purchase of supplies and equipment. Particularly as to the survey work, local men are given employment. The survey work done by the Forest Service is of a very high order and often leads to the satisfactory settlement of land line disputes that would have been carried to court except for the impartial, painstaking work of the Service. Land lines common to the tracts being acquired and those yet in private ownership are carefully established without expense to the land owners. The very careful title examination work carried on by the United States results in the discovery of many serious title flaws. It is always the policy of the title examiners to cooperate in the correction of defects. Such work benefits the owners of any land based on the same chain of title; for example, where only a portion of the original tract is being sold and in cases where the owner reserves certain underground resources, government title work often results in strengthening the title of property remaining in private ownership.

The examination, survey and title work done by the government may cost a total of nearly $1.00 per acre. Most of this amount finds its way into local trade channels.

Much of the land purchased for national forest purposes is acquired from local citizens. In such cases the money received from the government is available for use in the financing of local industry or for other productive purposes. The former owner is relieved of land taxes, nor does he have to carry the risk of the property being burned over and seriously reduced in value. Rarely does forest land return to its owner an amount equal to the carrying charges. In the vast majority of cases such land affords few or no current returns. In many instances the chance of a landowner to sell his hillside farm and the adjoining woodland to the government has made it possible for him to become established elsewhere and under conditions much more favorable, both as to net annual income and as to living and social conditions for his family.

Fire Control

Once a tract of land is approved for purchase it becomes the responsibility

of the local forest force to protect it from fire. Meeting this responsibility brings definite benefits to the local community. The fire control standards set up for a given national forest area are very high. Federal protection work is always more or less closely coördinated with state and or private protection work. The association of the two or more agencies in the one activity results in raised standards and increased effectiveness of each. A friendly spirit of rivalry spurs on each one. Since the Forest Service is a nationwide organization many advances, such as new tools, new equipment, and new methods are being worked out by its various units. Improvements are made known to each forest supervisor and by him are passed on to local coöperators.

In protecting areas of national forest, protection is necessarily afforded to considerable areas of adjoining land. National forest fire control work is advantageous to the local region in the following ways:

1. Increases production of forest products.
2. Improves watershed conditions through
   (a) Less erosion of barren slopes.
   (b) Less silting of stream channels.
   (c) Improved potability of stream water.
   (d) Less water in streams during flood periods.
   (e) More water in streams during drought periods.
3. Makes practicable effective forest management.
4. Improves recreational conditions.
5. Improves fish and game conditions.
6. Makes practicable long-term forest research projects.
7. Makes practicable demonstrations of long-term forestry practices.
8. Offers employment to local men as guards and fire fighters.
9. Gives added protection to property owned by others, such as sawmills, camps, farm buildings, fences, gas and oil property, etc.
10. Tends to stabilize forest conditions and this attracts the favorable attention of persons and industries seeking new locations, and encourages those already located in the region to improve their properties or expand their operations.

Road and Trail Work

Once a new national forest project has been established the Forest Service addresses itself to the improvement of the local road and trail systems. Roads and trails are necessary for the proper administration and protection of national forest land, for the removal of forest products, and to make the area accessible to recreationists. The Forest Service works toward the betterment of existing roads and trails and the construction of such new ones as are necessary. The benefits which accrue through national forest road and trail work may be summed up as follows:

1. Improved travel and transportation conditions.
2. Improved construction and maintenance methods; machinery and materials demonstrated.
3. Higher standards of construction and maintenance set up.
4. Higher standards of effectiveness per man-day and per dollar set up.
5. New types of road and trail structures introduced.
6. Local units relieved of a portion of the road burden.
7. The many local road units encouraged to work to uniform standards.

8. Local trade increased through the purchase of supplies and materials.

9. Local men and teams afforded work.

10. Favorable attention of tourists and recreationists attracted to the region.

11. Better and more roads and trails aid in the marketing of local agricultural, forest, mineral and manufactured products.

Improvements

In addition to the construction and maintenance of roads and trails, the Forest Service regularly proceeds with the development of the national forests through the construction and subsequent maintenance of such additional improvements as — telephone lines, ranger and guard stations, fire lookout towers and cabins, equipment depots, and the like. Forest Service telephone lines are made available for use by local settlers in so far as is practicable. They are always available in emergencies and often render very important community services.

Construction and maintenance of forest improvements offer local persons work for themselves and their teams and are regularly built of material purchased locally. Such improvements are carefully planned and are built and maintained to a high standard. This has a tendency to raise the building and maintenance standard of the whole community. High standard improvements attract favorable attention to the region.

Forest Management

The prime objective of national forest administration is the proper management of timber lands and forest resources. This objective may be briefly summed up as follows:

1. To bring about and maintain the most effective watershed protection.

2. To continuously produce forest products promising the highest net return in money value and improvement of forest capital by cutting mature, diseased, or defective stands, thinning where practicable to increase rate of growth, reforesting barren lands, and encouraging the closest utilization possible in view of economic conditions.

Scientific management of a national forest brings the following benefits to the local region:

1. Improves watershed conditions.

2. Provides continuous supply of forest products for use by settlers and wood-using industries, in other words, stabilizes forest conditions.

3. Increases the amount and quality of products produced by a given area.

4. Increases the percentage of most useful and valuable species.

5. Aids in the development of new and better uses for local forest products.

6. Encourages the use of new and better forest exploitation methods.

7. Forest planting is undertaken.

(a) Increases total production of region.

(b) Improves fish, game and recreational conditions.

(c) Affords labor to local men, and increases trade by the purchase of supplies.

8. Encourages the proper handling of privately-owned timberland.

One important result of all of the above is that it attracts favorable attention to the region, especially on the part of anyone interested in work or industry which may be benefited by

the stabilizing and increasing of production of forest products.

Forest Research

One function of each national forest organization is to carry forward, as may be practicable, forest investigative projects. These are for the purpose of adding to the sum total of knowledge necessary for the fullest realization of the forest management objective. As the results of such work are obtained they are put into practice on the national forests and disseminated for the benefit of all timberland owners.

Grazing

To the extent that it is compatible with silviculture, grazing is permitted. Grazing privileges are granted on such basis as to make them attractive to stock owners. Local applicants are given preference. Ten head of domestic stock may be grazed on national forest land without charge. In many sections the ranging of live stock on national forest lands constitutes one of the most important and profitable industries. The grazing resources of a national forest are administered along the same lines as are followed in the administration of timber resources. Grazing conditions are stabilized and the greatest practicable amount of forage is made continuously available, thus the local stock raising industry rests on a sound foundation. The availability of a local supply of live stock products tends to raise the standard of living.

Special Uses

Areas that are suitable for purposes that are more important than the growing of timber are made available on very reasonable terms for such uses. Here again the administration policy is such as to bring about the greatest good to the greatest number, having especially in mind settlers and those who visit the forest for recreation. Most common special uses are sites for picnic grounds, forest tourist camps, residences, hunting camps, summer homes, sawmills, railroad rights-of-way, stores, hotels, power stations, and pastures. Under the terms of special use permits the rights of both the permittee and the public are safeguarded.

Many areas, which are of especial beauty and charm, are set aside solely for the enjoyment and delight of the public. This policy, together with that governing the special uses of other areas, cause the forest to be visited each year by increasing thousands and hundreds of thousands of recreationists. With these visitors come many benefits to the local communities. Industry is increased, new ideas are advanced, outside capital is often interested in local projects, and the earning power of many settlers is increased.

Forest Service Personnel

Not all of the benefits of a national forest come directly through official channels. Benefits that accrue through forest officers and their families as individuals are important. Permanent forest officers are trained, carefully chosen men, most of them college graduates. Changes in personnel are more or less frequent. Forest Service

employees and their wives, almost without exception, take a constructive interest in the social and economic welfare of the regions to which they are assigned. Each one that comes is apt to have new and helpful ideas that make for the progress of the locality. The tendency is for the standard of living to be raised through the influence exerted by Forest Service personnel. Many contributions to the economic welfare of a locality have been made through suggestions and work on the part of forest officers. In many communities forest officers are among the most active and effective in efforts organized for the purpose of increasing local industry, securing good roads, improving school conditions, and raising social and moral standards.

Unfavorable Economic Effects

There are instances in which the establishment of a national forest in some ways unfavorably effects the local region. For one thing, with the passing of title to the government no more taxes are collected on the land. Part or all of the taxes formerly collected on the acquired area must be borne by the owners of the property still in private ownership.

The establishment of a national forest may tend, for the time being to reduce the amount of local industry. For example, a private owner might be willing to dispose of very fine young growth timber as cordwood. Were the property sold to the United States it is probable that the policy would be to defer cutting until the stand had reached a stage when more material of much higher value and usefulness could be obtained from it.

A third possible unfavorable effect of a national forest is that the presence of such a forest tends to discourage the development of state, county or municipal forests. However, it appears probable that in most instances the interests of the local region are better served through the medium of federal forestry.

The unfavorable effects in any instance are few, are rarely of serious proportions and are of relatively short duration. There are many cases where very early in the history of a national forest project the direct financial benefits entirely or very largely offset the loss of taxes. Twenty-five per cent of the gross receipts of a national forest are paid to the counties in which the forest is located. An additional ten per cent is used by the Forest Service on the public road system of the forest. Nor are the expenditures of the Service on public roads limited to this 10 per cent. The current annual allotment for road work to any one forest is apt to be many times the amount of the 10 per cent fund. In instances such allotments amount to more than the total gross receipts of the forest. Most of the road work done by the Forest Service is on local public roads.

There are certain things that can be done to the end that there be little or no financial embarrassment to local political units through the loss of taxes, for example: (1) acquisition extended over a long period, thus permitting the necessary adjustments to be worked out gradually; (2) use of road and trail funds in such a way as to

reduce the amounts that the poorer units must spend on their public roads; (3) increase receipts of the forest through the sale of stumpage, issuance of special-use permits and the like. In every instance the government policy is to aid local townships and counties in every way possible.

There are cases where stumpage that was not available for use before it came into government ownership has been placed on the market shortly after title has passed to the United States. In practically every case it is possible for the Forest Service to provide for the supplying of raw products to timber-using industries that depended upon acquired property for their supply. Often it is practical to work out a plan which results in cutting only a portion of the stand, or a supply may be made available from mature stands located in other parts of the forest. The policy is to so manage acquired land that the least possible interruption of local industry results.

After everything possible has been done certain unfavorable conditions should obtain it is certain that with the land in federal ownership conditions will steadily improve whereas, if private ownership were to continue, the converse is apt to be the case on many areas. That the federal government is making a contribution to the satisfactory working out of local economic problems is given recognition by certain states through provisions for aiding certain local subdivisions through periods of financial stress caused in part by the loss of taxes on land acquired for national forest purposes. The Commonwealth of Pennsylvania is paying five cents per acre per annum to townships and counties based on the net acreage of *state* or *federal* forest land.

Conclusions

On the basis of careful consideration of the economic influences of a national forest it seems that the conclusion must be that the favorable influences far outweigh the unfavorable, and that any locality inherently suited to development as a national forest would, in the long run, serve a higher usefulness if so developed. Thus it appears that within the limits that may be determined as necessary, the policy should be to establish new national forests and to increase the area of those already existing in the eastern half of the United States. It is believed that in such a program the federal government merits the encouragement and coöperation of the several states and of local political units.

FORESTRY AND LUMBERING IN BRITISH COLUMBIA[1]

By P. Z. CAVERHILL

Chief Forester, Forest Branch, British Columbia

The Province of British Columbia in managing its timber lands and in working toward the stabilization of the lumber industry has problems that differ little from those of the United States. British Columbia's method of attack is, however, different. The author gives data on the extent of the Province's timber resources, problems of its lumber industry, the responsibility of the state and private owner, and tells what his government is doing to relieve the pressure to liquidate holdings, improve marketing and make the forestry industries permanent.

THE PROBLEMS encountered in British Columbia are more or less common to the Pacific Coast. They are not materially affected by that imaginary, thin, dry line that stretches along the forty-ninth parallel and out through the Strait of Juan de Fuca. Policies differ slightly, but we north of the Line have developed our forest business along lines parallel with yours. We have the same methods, use the same types of machinery and equipment, have almost identical costs of production, and compete in the same markets. All conditions that affect you have a corresponding effect on us and vice versa.

In discussing forestry, let me first define the term. Forestry is those human activities dealing with the harvesting, marketing, and replacement of the forest crop. I have mentioned harvesting first advisedly, because the first crop was given us by a benevolent Providence. I would like to emphasize, however, the replacement of the forest crop, since here on the Pacific Coast we have been so immersed in the problems of commercializing our vast stores of mature timber that we sometimes forget that we must sow if we are to reap.

These forests so abundantly bestowed upon us are a product very largely of soil and climate, with the life-germ found in our tree seeds, modified, it is true, by environment and natural hazards, such as fire, insects, wind, and man. The man who imagines that on the advent of the white man this region was one unbroken forest of mature timber is very far from the truth. Openings of greater or less extent have always occurred, due to natural hazards. Man's influence has only magnified the destructive agencies.

In British Columbia we find great diversity in climate. Rainfall varies from 10 inches or less in the dry belt up to 200 inches in some localities on the North Coast. Temperatures likewise vary. We have the mild, moist climate of the Coast, with very little variation between summer and winter averages. Again, we have extremes as great as 160 degrees Fahrenheit. As we ascend the mountains from sea

[1]Address presented before Tacoma Lumberman's Club, Tacoma, Wash., December, 1930.

level, we get extremes in very limited distances. Similar changes in soil occur, from the alluvial river valleys to the glaciated plateau and the rocky mountain peaks. We find a corresponding change in forest types, but, in general, it may be said that the whole country below the 5000-foot contour will produce trees of commercial size. Even the far North, which one Coast logger a few years ago characterized as a "northern arctic region," has a climate similar to that of Winnipeg and milder than that of Central Russia, and the timber stands are comparable in character and size to those from which Russian and Swedish exports are now derived. It is true that these climatic extremes will be more marked in the rate of growth in future crops. We can only hope to obtain an annual increment of one-half or one-third that secured from the Douglas fir belt, but still these areas suggest potential resources of considerable value, when the time is ripe for development.

Timber Area and Stand

The total area of the Province is 372,000 square miles, of which 42 per cent, or about 100,000,000 acres, is timbered in some form or other. The mature timber area is probably not greater than 25 per cent of the latter or 25,000,000 acres and the stand 300 billion feet.

To the lumberman the ideal forest is one containing a heavy stand of easily accessible, clear, straight-boled trees. The forester prefers fully stocked stands of well distributed age classes, with no great accumulation of overmature timber, which is neither necessary nor advisable.

The conditions in our forests may be exemplified by the following figures taken from forest surveys. Of 8,000,000 acres on Vancouver Island, 4,200,000 acres or 52 per cent is productive forest land, 1 per cent is agricultural land, 47 per cent is barren or non-commercial scrub.

Of the timber-producing land, 3,700,000 acres or 90.2 per cent is mature timber containing 95,000,000,000 board feet, 1.8 per cent is restocked with age classes 20 to 40 years, 3 per cent is restocked with age classes under 20 years, 3 per cent is sparsely stocked, 2 per cent is not restocking, being recent logging, burns, etc.

Of 8,780,000 acres on the Coast islands and the Lower Mainland, exclusive of the Fraser Valley: 2,258,000 or 25.7 per cent is productive forest land, 0.3 per cent is cultivated, 74.0 per cent is non-productive mountain top, scrub, etc. Of the productive area: 1,533,000 acres or 67 per cent is mature timber with a stand of 27,751 million feet of saw timber, 2.6 per cent is restocked with stands over 20 years, 10 per cent is fully restocked with stands 1 to 20 years, 6 per cent is sparsely stocked with stands 1 to 20 years, 316,000 acres or 14.4 per cent is not restocking, recent logging, burns, etc.

Of 4,630,000 acres in the Interior: 73 per cent is commercial forest, 27 per cent is barren mountain top, water of brush land. Of the commercial forest 26 per cent is mature, containing

9.5 billion feet, 2 per cent is 80 to 100 years old, 4 per cent is 60 to 80 years old, 15 per cent is 40 to 60 years old, 8 per cent is 20 to 40 years old, 12 per cent is 1 to 20 years old, 6 per cent is recent burn.

These figures will give you some idea of the conditions in British Columbia forests. They are not ideal, but they are far from hopeless.

Lumbering

Sixty-six years ago, when British Columbia was little more than a fur outpost and a mining camp, a small schooner sailed from New Westminster to Sydney, loaded with Douglas fir. This was the beginning of our lumber trade. J. A. L. Homer, the shipper, had found in the new colony "green gold," which was to mean more to the Province than all the yellow product for which men fought and died. In the next two decades the business expanded slowly. In 1887, with the completion of the Canadian Pacific Railway, new impetus was given to the industry and the new Prairie market opened. Here I might point out one of the chief differences between our methods of handling our timber lands and yours. You acquire your rights in fee. We, on the other hand, grant cutting rights by way of lease or licence. One of the earliest on record was issued on November 3, 1865, covering a large part of the townsite of Vancouver, and it is of interest to note that the sole payment for this right was made at the rate of a halfpenny per acre per year, sterling. It may be of interest to note also that some ten years later steam tractors were used in logging this area, which is the earliest application of steam to logging on the Pacific Coast that I have been able to find. The donkey appeared some years later.

From this small beginning the industry has grown until the products of British Columbia forests are found in all markets of the world. The industry is our chief national activity, utilizing 3,000,000,000 feet annually of raw products, producing $90,000,000 in new wealth, returning to the Provincial treasury some $4,000,000 annually, and employing one-fifth of our population.

Problems of the Lumber Industry

If you follow the course of this development, you will find that it has not been a normal, healthy growth. You are struck by sporadic periods of expansion, followed by depressions first, during the first decade of the present century, and, again, during the past decade in particular. In these, I believe, you will find the cause of our present ailments. During the first decade we had a period of rapid rural development and railroad expansion, and the per capita consumption of lumber rose far above normal, reaching the five-hundred-foot limit. The first cry of "timber famine" arose. Our governments in the West saw their vast unproductive timber resources and, wishing to secure revenue therefrom, opened them for private exploitation. We, in British Columbia, by the staking of free timber licenses; you, under the provisions of the Home-

stead and the Timber and Stone Acts. With the culmination of these factors arose a boom market, a cry of famine, and free timber. Conditions were ripe for wild speculation in timber, and the public was not slow to bite. The result was inevitable,—an acquisition of timber holding far in excess of the market requirements. In British Columbia, between 1906 and 1908, 15,000 square miles of timber were taken up, with an estimated stand of 200,000,000 M feet, which the holders expected to liquidate in twenty years. New logging camps were opened and new mills constructed to accomplish this objective, and our products were thrown on the market in competition with those from better known and developed regions.

The lumber famine did not arrive on schedule, due to various reasons. Per capita consumption declined rapidly. The inevitable slump came, but was partially obscured by the War. The second expansion, partially encouraged by a post-war boom, has really been an expansion of desperation. Wearied from holding frozen assets for a lifetime and faced with rapidly mounting book charges and increased taxation, on the one hand, and very nominal increases in stumpage to offset these, the owner wishes to liquidate at any cost. Again, new mills are erected and new logging camps opened, with new and better equipment to speed up production and reduce costs. The consequence, a flooding of the market. Then we tried to beat the game by further speeding up and running double shift, to cut down overhead, reduce prices and encourage buying.

The present general slump was only the last straw, but, even then, we did not have any systematic curtailment, but a piling up of yard-stocks and cut-throat methods of selling. I know of no better way to prevent a consumer from buying than accumulating stocks, a "blue ruin" cry, and the dropping of prices from day to day. Had we made the curtailment, now forced upon us, as a voluntary gesture in 1929, with a holding for a reasonable price, many extra thousands of dollars would have come to our pockets during the past year and much timber would have been saved. Lumber is not a luxury product and its use will not be greatly extended by a drop of a few cents per thousand. Its use is governed largely by its utility in comparison with substitutes, by the idiosyncrasies of the building trades, and by the faith we have in it.

The past cycle of development has aimed for quantity production, in which only the highest quality of stumpage has been used. Douglas fir is being cut faster in ratio to the stand than any other species. In British Columbia, in twenty or twenty-five years, mature Douglas fir will have ceased to be a general factor in lumber production. Inferior species and the smaller-sized logs have been broken down and wasted in millions. The result has not been satisfactory from an industrial and financial point of view, and is far less so from a forestry standpoint. Great areas of forest have been swept away, leaving

no vestige of seed-trees or seed supply. The waste is creating an ever increasing fire hazard and a devasted and desolate landscape. The profits have not warranted expenditures for replanting or even adequate consideration of the areas of second-growth that spring up more or less abundantly when fires are kept out.

In this, perhaps, our governments are as much at fault as you lumbermen. In the beginning they were too anxious for revenue from a frozen resource and, once having secured that revenue, have made commitments which must be discharged, often requiring increasing amounts which could be obtained only through increased taxation. In this respect they are very much like you individuals, who have got into the hands of your bankers, but these conditions cannot go on indefinitely. Already we hear public mutterings against destructive logging and the waste resulting therefrom. We cannot afford to see 50 to 75 per cent of the productive area of the state laid waste, land which will, if properly handled, return as much in labor, in national income, and in revenue, as if cultivated and brought under agriculture.

Speaking of waste reminds me of a very illuminating visit to a sawmill in Finland which produced about 100,000,000 board feet of lumber. As an adjunct to the sawmill was a pulp-plant producing 22,000 tons of sulphate pulp. Again, the waste of the pulp-plant was turned over to a chemical plant and the products consisted of 500 tons of laundry soap, raw and refined soap fat, pitch, printer's ink, turpentine, hydrate, turpencol, and methyl alcohol. The statement of the manager struck me very forcibly: "It is from these by-products that we derive most of our profits." Those profits had averaged 18 per cent over a six-year period, 1918 to 1924, inclusive.

On the West Coast one can already note a change in the offing. Selective logging, the development of the pulp-mill as an adjunct to the sawmill, and the introduction of the Swedish gang-saw, all indicate that we are entering a new phase in which closer utilization and better quality will be the keynote. This is going to require the same time and thought previously given to the development of what I would class as the greatest log-producing factory the world will ever see. We must devise new and more flexible equipment, we must have a better understanding of the qualities of our raw products, we must study the needs of the market and how we can substitute our new products for old. This is going to require coöperation not only between you lumbermen, but between the industry and the various governing bodies, state and federal.

I have previously stated that the governments are partially to blame for the present conditions in the industry. Through encouraging timber acquisition and through high taxation they are encouraging destructive logging. They should now take a hand in the solution by withholding further timber reserves, except those units which must be logged with adjacent timber. Mar-

ginal timber or timber for the establishment of new mills should be removed from the market altogether, whether under public or private ownership, and some system of taxation and protection worked out which would remove the incentive to liquidate. We, in British Columbia, are in this respect better off than you. Our major timber holding is under license with an annual carrying charge of 22 cents per acre, the major payments being made as royalty when the timber is cut.

After curtailment, marketing offers a wide field for development. In this, I do not wish to cast any reflections on the good work done by the various associations in market extension work, but after all I know of no product (except possibly agricultural products) which is pushed on the market in as haphazard and unscientific a way. This is possibly due to the individualism of our lumbermen, a hang-over from the day when the sawmill was a community institution where every one came to buy and was glad for what he could get, because there was no substitute within his reach. Through our forest products laboratories we are just beginning to learn the value of our woods. How best can we get this information across to the consumer? I am fully convinced that this must be by coöperative effort. Coöperative marketing has been worked out in Scandinavia. It has been developed more or less in pulp and paper. Why not in lumber? At least through coöperation we could have a stabilized price-list for three or six months and confidence reëstablished in the buyer.

But why not service sales? Why not take a lesson from the auto, the radio, and the insurance salesman? Ford cars would not be half so popular except for the fact that they can be serviced at almost every road junction. There are millions of rundown homes which need an overhaul. It is true you cannot run them into a lumberyard, as you would a car into a garage. My thought is that many of these home owners would welcome advice and help from a service man, and in the end would be better satisfied with the job than if they had selected their material from the abundance of attractive literature on substitutes.

Too big a job for the individual lumberman? Yes, certainly! But a coöperative lumber yard with a corps of service men is perhaps practical.

The British Columbia Plan

In British Columbia we have to a large extent been working along the following general lines:

Starting from 1910, when we found that we had disposed of 15,000 timber licenses under a contract to cut which expired in twenty-one years, and that the cutting of this 200 billion feet would not only flood the market, but seriously impair the future well-being of the Province.

1. We have changed our timber license tenure from twenty-one years to one renewable in perpetuity, thus removing any pressure to liquidate under the contract.

2. We have fixed the maximum annual carrying charge at 22 cents per acre on the Coast and 16 cents in the

Interior. These prices carry until 1954.

3. We have built up a forest protection service under government supervision, and thus united the authority. On this project we are spending $800,000 per year, and, while we are inadequately financed to give adequate service, we have been able to keep pace with the increasing fire hazard and maintain a high percentage of fires extinguished before reaching ten acres.

4. In coöperation with the industry we have undertaken trade extension work, realizing that in the question of wider and better markets is at least a partial solution of our problem.

5. We have in progress a survey of the resources of the Province to secure more definite information on the area, quantity and accessibility of our timber, and the location, age, quality and growth-rates of our second-growth areas.

6. We have built up a research organization to deal with the many problems facing both the lumberman and the forester. Forest products research under the federal government deals with problems of wood utilization, strength, uses of wood, methods of kiln-drying and handling, sawmill waste studies and lumbering waste studies. The Provincial research has dealt largely with silvicultural problems; volume tables, yield tables, regeneration studies, when can we hope to secure adequate natural regeneration, and what are the reasons for failure in many cases. Already many interesting facts have been accumulated. We are also carrying on experiments with our second-growth stands to secure data on management for the best financial returns. Thinning experiments aim at: (a) Production of even-aged stands for clear cutting; (b) Production of many-aged stands for periodic selective cutting; (c) Thinning for control of character of wood crop.

7. We are reserving as Provincial Forests, dedicated to the perpetual growing of timber, those areas found more suitable for this purpose than for agricultural development. Already seven million acres are so dedicated. Certain of these areas are set aside for research and demonstration purposes where the silvicultural theories evolved by our research division will be put into practice on a commercial scale. Through coöperation with the Federal Forest Service a program is now being worked out, which will very materially speed up this phase of forestry. Finally, recognizing that part of our cut-over and burned-over land will not reforest naturally, we are developing a forest nursery, capable of producing two million trees per year, and on Provincial Forests will undertake planting to restock such areas. The first commercial planting was done this year and a much larger area will be planted next spring.

Finally, I would like to emphasize that in our forest problems we have a great opportunity and a grave responsibility. The forest is a crop (the product of soil and climate) to be tended, grown, and harvested from time to time. Your business should be built

on this fact rather than on making the greatest profit from the first harvest. It will be better for your country and better for your heirs and successors to hand on a mill, a stand of thrifty second-growth, and your good will, than to bequeath millions in cash.

I am not unmindful of the difficulties you face. I am not unmindful of the fact that the public at large little understands your problems and that, as previously stated, liquidation is often forced on you, but I have faith in wood as a necessary raw product. I have faith in you who have already overcome so many difficulties and I have faith in the people of this Pacific Coast, and I believe that through coöperation a way will be found. It may be that the present slump is the very thing that was needed to make us pause and take stock, and that when the morning dawns the sun will be breaking through the clouds.

BRIEFER ARTICLES AND NOTES

A Method of Mapping Detail on Sample Plots Under Heavy Brush Cover

In the spring of 1931 a series of permanent growth plots were established on recently cut-over lands in the oak-pine type of the South New Jersey Coastal Plain. Most of the areas had been burned over in May 1930, and were planted to white, pitch and shortleaf pines in 1931. Hardwood sprouts coming up since the fire, and ranging in height from one to three feet, were present on the ground. A few plots were located in dense scrub oak which had escaped the burn. The purpose of the experiment was to obtain an accurate annual record of the fate of the planted stock in competition with the hardwoods. Square plots, one-quarter and one-half acre in area were used, and in addition to the permanent corners, a post was set at the center of each plot, for mapping control.

In accordance with the method suggested by the Society's Committee on Standard Sample Plot Technique, a numbered aluminum tag attached to a No. 12 galvanized wire pin was thrust into the ground beside each planted tree. In mapping the seedlings a traverse board set up over the center post, was used. The density of the brush, however, made the chaining of the distance to the trees, both slow and inaccurate; therefore another method for obtaining these measurements was devised. The procedure was as follows:

1. Carpenter's cord was strung tightly between the permanent corners, thus definitely locating the exterior boundaries of the plot.

2. A temporary pole was set up half-way between the center post and each one of the plot corners. Cord was stretched between these, care being taken to see that it was tight and not deflected from a straight line by brush. The plot was thus divided into two concentric squares. In the case of half-acre plots, it was found desirable to establish three such squares, by trisecting the distance from the center to each corner. The temporary poles were 2″ oak saplings, 8 to 10 feet long, sharpened, and with a white flag tied to the tip.

3. After orienting the traverse board, the corners of each square were located in the usual way and plotted to scale. Connecting lines representing the stretched cords were drawn.

4. In mapping the seedlings, a 3-man crew—one mapper and 2 rodmen—was used. Rodman No. 1 would first locate a seedling and record its number in a notebook. The second

rodman following closely behind, then held a range pole on it, calling out "Tree," to the man at the traverse board, who sighted on it with the alidade. In the meantime man No. 1 had placed himself on the nearest stretched cord, and was lined-in with the tree, by the mapper. The distance from the seedling to man No. 1 was then measured to the nearest foot with a range pole, and the distance together with the tag number called out by the second rodman for plotting.

5. On completing a plot, the numbers tallied by man No. 1, were compared with those plotted. Occasionally a figure occurred on the check list, which due to some error, did not also appear on the map. In such case the numbers which immediately preceded and followed it on the list, were located on the map, and from their positions the probable location of the missing seedling on the ground predicted with considerable accuracy.

The most difficult conditions encountered were on areas where the scrub oak cover ranged from 80 per cent to 90 per cent density. With a little practice a 3-man crew was able to establish the string control on a half-acre plot in about 20 minutes. In such case the 4 permanent corners and center post had of course already been set, and the exterior lines brushed out. The mapping of 200 tagged seedlings under such conditions, required about 2 hours time for a 3-man crew. The longest measurement necessary was found to be 17-feet. The great bulk of the measurements were 10-feet or less.

Some of the advantages of the range pole over the chain for measuring distances were the saving of time in handling, the elimination of deflection from alignment due to brush, and the greater ease of passing the pole through dense clumps of sprouts.

E. B. Moore,
Assistant Forester, New Jersey Department of Conservation & Development.

The Economic Application of Forest Research[1]

"The acid test of any research is the degree to which its results help to understand life and contribute to the guidance of the activities of the private and public agencies, states and government. It has been the policy of the Station, during the eight years of its existence, to attempt investigations which contribute directly to the solution of the most pressing problems.

"The whole field of forestry is still going through an adjustment to the rapidly developing economic changes in the region. Forestry is still permeated with economic considerations such as conflicting ideas of land use, rapidly increasing tax delinquency, shortage of certain forest products, like spruce pulpwood, overproduction and surplus of other products, rising taxes, competition with the Pacific Coast, and even European countries. All these leave an impress upon forest

[1]Excerpt from the investigative program of Lake States Forest Experiment Station for 1930.

investigation. What, for instance, agitates and affects the public mind in the Lake States? Is it the technique of planting, the drought resistance of different kinds of trees, the light and soil requirements of our forest trees, methods of thinning? These problems have a place in the research work of the Station, but that is not what the public is most interested in. What the public wants to know is, what can be done with the cut-over lands of the region? Should they be turned into productive forests, developed as recreational areas, or used for propagation of game? How can the abandonment of cut-over land be stopped? Can forest tax laws prevent the flow of land into public ownership? How will such laws affect the finances of local communities? Can zoning help the situation? What kind of a tax can cut-over land stand? Is agriculture likely to take up much cut-over land? How much commercial forest still remains in the region? What is the present growth on the forest land? What is the future of lumber? These, and similar questions, occupy the mind of the public and it is naturally looking toward the Station for help in reaching an answer.

"No matter what investigation the Station may undertake, it inevitably comes to the economics of the situation.

"The forest economic problems occupy, therefore, a prominent place in the investigative program of the Station and give practical significance to most of its projects. But, forestry and biological problems are not being overlooked for they, after all, are the basis for sound economic policies. How can one determine, for instance, whether private forestry is possible without knowing how fast timber grows under various conditions? How can forest planting be advocated if we do not know what seed to obtain, how to store it, how to raise the young trees, and how to plant them most successfully. How can an intelligent plan of fire protection be devised if no statistics exist as to the seasons when fires occur, the causes of fires and the general climatic and forest conditions which increase or lessen the fire hazard?"

The Scheme of Forest Fire Control[1]

Most of us who talk forest fire control and fire research, including those who practice without talking, encounter the inherent complexity of the problem and experience difficulty in fitting any individual case into the particular background and perspective of the person to whom we are talking. Probably no two men would diagram or describe all the details of the forest fire problem so that they bore the same relation to each other or occupied positions of equal prominence in both cases. Each man is naturally influenced by his own experience and by the local importance

[1]Acknowledgment is made to Messrs. Kotok, Show, Sparhawk and G. M. DeJarnette who have encouraged the writer in working on this "Scheme", and who have made constructive suggestions for improving it.

Table 1

THE SCHEME OF FOREST FIRE CONTROL

Factors	Problems	For solution by experienced common sense, opinion, study, investigation, research.	Administrative action
Destructive resources. Standing timber & reproduction Forage Soil productivity Water control Scenery and recreation Wild life	Justifiable loss. A problem of economics and technical forestry, rather than in administrative fire control Basic to the problems listed below.	Measuring the physical losses and determining their values.	Determination of degree of protection to be given by timber types and areas.
			Education, legislation, control of use of fire.
	Prevention.	Influencing the public.	Slash, snag, and debris disposal, fire breaks, better utilization.
		Reducing inflamability.	Silvicultural control of species and shade.
Causes. Man Lightning			Number and distribution of men. (Their daily use.)
	Presuppression.		Lookout stations, ground and air patrols.
		Inspection and training.	Roads, trails, landing fields.
Hazard. Fuel types Climate and weather Accessibility Topography	Suppression.	Speed and strength of attack.	Equipment. Telephones, trucks, pack stock, pumps, tractors, plows, other tools, standardized cargoes.
		Methods of suppression.	Tactics of suppression. (Where to build line to check fire. How to build line to control fire. What to do along the line to put fire out.)

of certain phases of the problem with which he is especially familiar.

Without doubt this is a natural condition considering the complexity of the field of fire control and considering the variations of the problem that occur in such a large country as ours. But so long as this confusion continues the person talking and the person listening, or reading, are apt to fail to agree, not because of disagreement concerning the particular facts presented, but because one man views these facts from and entirely different angle than the other. And these viewpoints are as various as the possible conceptions of the composition of the whole picture. Furthermore, it often happens that one man weighs the facts in scales built from wide experience and knowledge while another judges the importance according to a more restricted contact with the problem. In such cases agreements are naturally hindered until a mutually satisfactory background or basic ground is established.

Eventually the basic composition of the scheme of forest fire control may be defined in great detail to everyone's satisfaction, but in the opinion of the writer there is a real present need for a simple outline to serve this purpose. The "Scheme" offered in Table 1 is, therefore, not presented with any contention of completeness or finality, but rather as a suggestion of the primary components, as the writer now sees them.

The designation, "Scheme of Forest Fire Control," is used according to the dictionary definition of "scheme," meaning: "a combination of thoughts, theories, or the like, connected and adjusted by design." Undoubtedly, others will disagree with both the thoughts and the design presented, and will be able to improve them. But from each improvement, made available to the profession, we shall all profit by standing closer together upon common ground as we think about, write about, and discuss this complex field of endeavor.

H. T. Gisborne.
Northern Rocky Mountain Forest Experiment Station.

Utilization of Rough Top Logs

For some time, and especially since the slump in lumber prices made the manufacturing of low grade lumber in particular unprofitable, there has been complaint from western yellow pine operators that they could not afford to remove from the woods top logs, regardless of size, if they were so knotty and rough that only No. 4 or No. 5 common lumber could be produced from them.

Experienced scalers know of course that if a tree top has a rapid taper due to many large branches it may produce less actual scale when bucked up to say an 8-inch or 10-inch top diameter, than if 4 feet or even in extreme cases 12 or 14 feet was discarded, and the tree scaled on its shorter length but larger diameter, and also, of course, that the operator's overrun lies principally in these rapid taper logs.

Certain operators have for some time been practicing the leaving of rough tops on their own lands, in one instance going so far as tagging all trees to be cut and to note on the tag the number of logs to be bucked out. Small or very rough or crooked trees were not tagged for cutting. The result was that occasionally even as much as a 32-foot log was left in the top.

In connection with this repeated protest against utilization of unprofitable material a short study was made on an Eastern Oregon operation of the comparative scale of individual trees when scaled (1) for their full merchantable length, and (2) when from 4 feet to 14 feet of the top was discarded on account of low quality of the product to be derived from it.

The study was carried on in mature western yellow pine that had been felled and bucked under the full utilization method. The trees selected, 34 in number, ran 2,950 broad feet to the stump, gross scale.

Trees selected for the test were such as, while straight and sound, would produce only quite low grade lumber on account of the number or distribution of large knots. Quality alone, and not the size, of the top log was the criterion.

The procedure was first carefully to caliper-scale the tree as bucked under full utilization, then recaliper and rescale one or more of the top logs, assuming them to be bucked in lengths that would eliminate the undesirable top portion.

Table 1 shows in condensed form the results of the scale.

On analysis it appears that if rough tops were eliminated, while the operator would be relieved of handling unprofitable top material, he would at the same time lose as follows:

Pay for 200 additionl feet of timber at $3.25 per thousand broad feet	$ .65
Discarded material 1180 broad feet (Scaled) at $3.25 per thousand broad feet	3.80
Overrun on discarded material (177 broad feet estimated) at $3.25 per thousand broad feet	.57
	$5.05

Or, the equivalent of $.05 per thousand on the trees so scaled. In other words, the privilege of discarding top logs, scaling on the average 35 board feet each, has cost him for each tree $.1475.

On the other hand the stumpage revenue is increased by 200 board feet at $3.25, or $.65 on the total volume so scaled.

Government timber sale contracts are

Table 1

EFFECT OF UTILIZING ROUGH TOPS

Under full utilization			With rough tops eliminated		
Total scale board feet	Average top diameter inches	Average length discarded feet	Average top diameter inches	Total scale board feet	Total scale discarded portion board feet
100,600	10.75	8.41	16.11	100,800	1,180

so drawn as to provide for full utilization, or the prevention of waste of merchantable material in the tree. However, under present conditions in his business, the timber operator has a strong argument against being compelled to utilize a grade of material that is scarcely saleable, or, if saleable at all, only at a price below production costs.

WALTER J. PERRY,
Chief Lumberman,
Deschutes National Forest.

NOTES ON THE PULP AND PAPER INDUSTRY IN LOUISIANA

Foresters will be interested in recent developments in the pulp and paper industry in Louisiana. While pulp and paper companies are not new in the state certain recent changes may or may not be indicative of a trend worthy of consideration. This note is merely an attempt to enumerate these changes and some of the factors influencing them without drawing any conclusions.

During 1929, according to figures issued by the State Department of Conservation, there was produced in Louisiana by seven companies 245,218 tons of pulp. Last year and this year have seen three important changes in the set-up of these companies.

On January 1, 1931, the EZ Opener Bag Company dismantled its plant at Braithewaite on the Mississippi River below New Orleans, and moved to Tuscaloosa, Alabama, consolidating with their plant there. The New Orleans plant was not as well located in regard to pulpwood supplies as it might have been but was exceptionally well located in that its products could be carried to northern and eastern markets by water as well as by rail. Fuel was a problem as natural gas is not available at Braithewaite.

The Brown Paper Mill Company located at Monroe, during 1930 increased its plant capacity from 165 tons per day to 400 tons per day. This mill is located in the loblolly-shortleaf region of the state near large areas of bottomland hardwoods. These can readily be drawn on when the pulping of the hardwood species is more feasible than at present. It is located near the Monroe-Richland natural gas field and so has an abundance of cheap clean fuel.

The Southern Advance Bag and Paper Company is a subsidiary of the Advance Bag and Paper Company with mills in Maine, Ohio and Louisiana. Recently the citizens of Jackson Parish, where the Louisiana mill is located, voted a five-year tax exemption on an addition to the present plant. This addition will mean an increase from the present capacity of 120 tons to 205 tons of pulp daily. While definite announcement has not yet been made it is believed the company intends to move its Howland, Maine plant to Louisiana. There will also be a new power plant built by the company. This concern uses natural gas for fuel, and owns an eleven-inch pipe line from the Monroe-Richland field. The timber lands of the company are predominantly in the lob-

lolly-shortleaf area though a portion of their holdings are in the northern part of the longleaf belt. Hardwoods occur in abundance along the creek banks and the company is using various percentages of hardwood pulp along with the pine pulp in its paper. Oak as well as the gums are being used. This mixing of pulps has been developed because the company realizes it cannot continue the cutting of pine indefinitely if all the hardwoods are left standing in the woods.

In the JOURNAL OF FORESTRY, Volume XXIX No. 1, Wackermann pointed out that during the early life of an operation the cost of pulpwood purchased is lower than the cost of pulpwood cut from the holdings of the company. In Louisiana this is reflected in the large pulpwood purchases of companies that are organized solely as pulp and paper companies. During 1929 the paper mills of the state expended $1,650,600 for pulpwood purchased from farmers and similar small landowners: In 1930 the purchases amounted to $1,668,660—(this is based on actual figures from the books of all the companies except one and average figures for that company). One firm buys its entire annual pulpwood requirements of 190,000 cords while another has been buying 80 per cent of its requirements. The latter company has been paying, prior to the present depression, $5.00 per standard cord delivered at the mill while its own pulpwood cost $6.25 per cord at the mill. This same company has been taking title to all the lands of a lumber company as fast as the saw timber is removed. Under the contract terms the use of skidders in logging operations is prohibited to prevent damage to advance reproduction. Cutting is to a diameter limit.

Two of the pulp mills are connected with sawmills. These are two of the oldest mills in the state and are located in the longleaf belt. Tops are, of course, the chief source of pulpwood for these concerns and with the end of their saw timber in sight the companies are giving considerable thought to the future of their plants. One firm has already purchased several tracts of land well stocked with pine of pulpwood size and smaller.

With all factors given due weight the future of the pulp and paper industry in Louisiana seems to be bright. There are still large areas of land well stocked with young timber that offer considerable inducements to paper companies seeking a location. It might almost be safe to say the pulpwood resources of the state have hardly been touched. The rapidity with which the timber of the South grows; the proximity of large natural gas fields; the abundant supplies of pure water readily available by means of artesian wells and the splendid transportation facilities by both rail and water are all favorable to additional plants. Another factor which will doubtless loom large in the opinion of company officials is the cordial attitude of the people of the state as shown by the action of the citizens of Jackson Parish. Future developments are, of course, dependent on the business revival but Louisiana should share in the improvement when

it arrives. This will be particularly the case as new commercial processes for pulping hardwoods are developed.

ROBERT MOORE,
Extension Forester,
Louisiana State University.

WORK BEGUN ON NEW FOREST PRODUCTS LABORATORY

Providing for the construction here of the largest and most complete establishment in the world devoted to research on wood, contract has been awarded by authorities of the U. S. Department of Agriculture, Washington, for a new fireproof building for the Forest Products Laboratory, at Madison, Wisconsin, to be completed in one year. This contract is the principal award under a $900,000 Congressional appropriation to provide the Laboratory with adequate quarters and equipment. Work of excavating for the foundation is already well under way.

In its six stories, with total floor space of 175,000 square feet, the new building will contain modern technical and scientific facilities for testing and investigating wood and other forest products in manifold uses and transformations, from logs, poles, and lumber to pulp, paper, and turpentine.

DRY KILN EQUIPMENT

A large group of dry kilns equipped for close control of temperature, humidity, and air circulation will help to solve the problems of seasoning many species and types of wood. A cold storage chamber will be provided in which green logs and timber can be kept in unchanged conditions for experimental work at any time.

Since every step of wood manufacture and construction and the satisfactory performance of wood in service are influenced by moisture conditions, a number of humidity rooms will be provided in which wood can be brought to the exact moisture content desired for study under conditions simulating any season of the year or any climate of the temperate zone.

TIMBER AND PULPING RESEARCH

Machines for testing timbers and framework up to a breaking load of 1,000,000 pounds will be served by cranes in a testing gallery accommodating pieces and panels as large as 30 feet high and 100 feet long. Tests of boxes and shipping crates can be carried on at any degree of dryness or dampness that would be met in service by storing and testing the containers in a special moisture-control room served by movable machinery.

The pulp and paper research laboratory, occupying six floors at one end of the building, will include grinder equipment, a digester tower 40 feet square, beating and refining apparatus, and an experimental paper machine with all moving parts under precision control. With this equipment the study of various American woods as pulp and paper raw material will be continued, along lines that have already broadened the pulpwood market and pointed the way to improved chemical pulping.

X-RAY ROOM FOR WOOD

Among unusual features of the building will be an ultraviolet ray chamber, where wood can be sterilized for mycological studies and where paints and other materials can be exposed for test, an X-ray room providing for the examination of the minute structure and growth characteristics of wood, a microphotographic studio, and a stone table and shaft for ultracentrifuge apparatus to determine molecular sizes of cellulose and other wood components.

Provision is made for a large timber preservation laboratory, a wood fermentation unit, fractionating stills, a general section of wood chemistry, wood gluing, painting, finishing, and fireproofing laboratories, and facilities for the study of wood fungi and insect pests and the abatement of their damages.

MODERN SERVICE FACILITIES

To serve this establishment, extensive equipment will be required, including a railway siding, a power plant of 630 boiler horsepower, and a number of service elevators, hoists, and monorails. Direct and alternating electric current at various voltages will be supplied to workrooms, and steam at high and low pressures will be piped to processing apparatus. Chemists' benches will be supplied with water, gas, compressed air, steam, and electricity. A forced ventilation system will be used for chemical hoods, pulp digesters, and other units as required.

A sawmill, planers, and complete woodworking shop will prepare test material in all sizes, shapes, and forms of construction needed, while wood for experimental pulping and paper making will be prepared in a room equipped for barking, chipping, and grinding.

COOPERATION WITH UNIVERSITY

Since the Forest Products Laboratory was opened by the U. S. Department of Agriculture, in 1910, it has occupied buildings owned by the University of Wisconsin. This assistance is based on the original coöperative arrangement whereby the Laboratory is available to the university faculty and advanced students for research, and its staff gives lectures in the university on wood chemistry and technology and other subjects related to forest utilization.

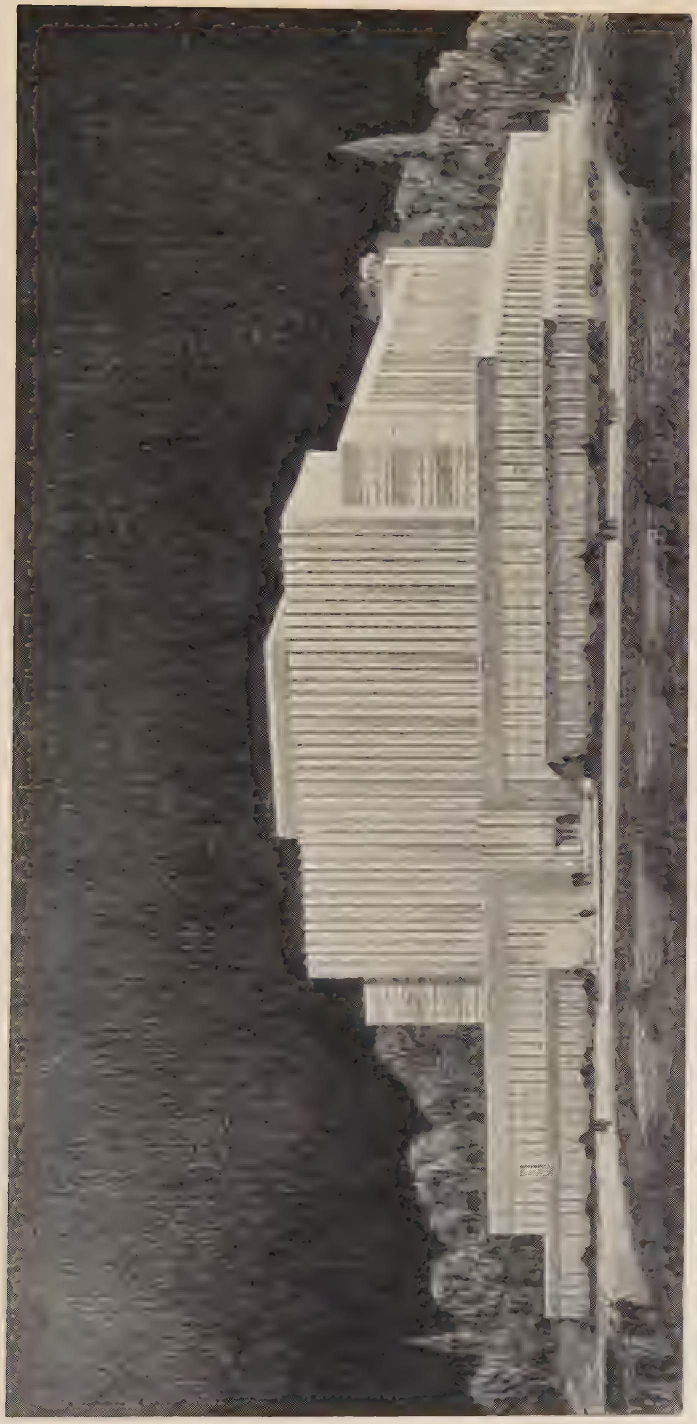
The university board of regents has aided the new building project by donating a choice site of 10 acres overlooking Lake Mendota and the university campus.

CONSTRUCTION FEATURES

In general plan the new building will be U-shaped, about 275 feet in length and over-all breadth. It is of modern design, emphasizing "stepped-back" construction, vertical lines, and large areas of glass in the external walls. By terms of the Congressional authorization act, the building will be of fireproof construction throughout.

C. B. Fritz & Company of Madison, Wis., were the successful bidders. Holabird and Root, Chicago, are the architects. Davidson and Constable, Stamford, Conn., assisted in the landscaping design.

The modern spirit which dominates



Architect's sketch of the new building to be built in Madison, Wisconsin, for the U. S. Forest Products Laboratory.

the design has discarded outworn symbolism, according to the architects, who gave the following comments on their plans:

"The architectural conception of the building is essentially modern in its effort to achieve, through the massing of the required utilitarian elements of the structure and through the treatment of the preponderant surfaces of glass, a classical and balanced whole suitable to the dominating site. This is an attempt at the true classical feeling through the natural dictates of the problem, rather than through the use of obsolete forms and expensive decorative elements. If this effort is successful, it will have been achieved in a logical manner and with a minimum of expense."

Naval Stores Station Located in Osceola Forest of Florida

The Naval Stores Experiment Station of the U. S. Department of Agriculture's Bureau of Chemistry and Soils, for which the last Congress appropriated $40,000, and for which ten cities and localities in Georgia and Florida recently offered free sites and facilities, will be located in the Osceola National Forest at Olustee, Fla., according to the announcement made public by Dr. Henry G. Knight, Chief of the Bureau of Chemistry and Soils.

Dr. W. W. Skinner, Dr. F. P. Veitch, and V. L. Harper, the committee of naval-stores specialists from the Bureau of Chemistry and Soils and the Forest Service chosen to select a site, report that after inspection of the ten different communities Olustee, Fla., was selected as the location from which the new experiment station can best serve the entire naval stores industry of the South.

Olustee is on the edge of the Osceola National Forest, only a few miles south of the Georgia-Florida line, in the heart of the great yellow-pine area, surrounding the Okefenokee Swamp where surveys have shown that longleaf and slash pine reproduce more rapidly than at any place in the United States. The Osceola National Forest practically borders on and forms the watershed of the famous Suwannee River.

The station will be in that part of the Osceola Forest which the Forest Service will devote to research on gum production. The scientific research by the Bureau of Chemistry and Soils will be closely related.

The committee regards the control of gum from government-owned land and the coördination of the naval-stores work with that of the Forest Service, which this site makes possible, as a great advantage and one which assures permanency of control and occupancy by the department. This control, they point out, can not be expected with privately owned land, even under the most sympathetic coöperation, since the destruction of trees or the cost of material is an expense too great to expect of any collaborator.

The selection of the site in the Osceola Forest will enable visiting producers to see and study on a single

trip the whole subject from the woods work by the Forest Service through the still work and packaging by the Bureau of Chemistry and Soils.

One consideration which guided the committee in the selection of Olustee is its accessibility to naval-stores producers of Georgia and Florida by good roads and railroads. The town is only 12 miles from Lake City, a railway center where mechanical service and supplies are available. Also, the area surrounding Olustee contains several different types of soils and has a large available supply of gum from each of the turpentine-yielding pines, approximately 50 per cent longleaf and 50 per cent slash, which will enable thorough study of the gums and the development of products.

The Third Sawmill Engineering Conference

The Third Sawmill Engineering Conference, held the latter week in May, 1931, was as successful as its two predecessors. This annual affair bids fair to excel its older relative, the Pacific Logging Congress, in things accomplished. The attendance, as might be expected, was much smaller than that at the older Logging Congress, but it was an active, progressive, earnest—and sober—group that sat down this year to discuss important technical phases of sawing, handling and conditioning lumber. If the standard set by the third meeting continues to improve, the sawmill industry is due for some important changes. Tradition has dictated not only methods but adherence to old types of machines for converting logs into useful lumber, but tradition is being given a blow on the chin by the sawmill engineers. True enough, air and electric dogs have been added to the log carriages during the past ten years, the Scandinavian log gang saw has made its appearance as a "head saw" and dry kilns have been greatly improved. But there is still much room for improvement. We still saw triangular boards from the high grade material on the outside of large tapered logs for no good reason at all; we still submit to the wastefulness of the edger and trimmer; and we still handle lumber uneconomically and dry it with much loss. The lumber manufacturing plant has been considered by some as not offering much hope for reduced costs of production, but a growing number of others see a possibility of saving a few cents here and a few nickels there.

The Sawmill Conference was fathered by the same man who founded and so long nursed the now great Pacific Logging Congress—George M. Cornwall, editor of *The Timberman.* His son, George F. Cornwall, is continuing the good work as secretary and organizer of each annual gathering. One wonders why the engineering societies, such as the American Society of Mechanical Engineers, have not sooner had their counterpart in the sawmill world, nor why they themselves have not paid more attention to the technical phases of lumbering. The automotive industry was still in its swaddling clothes when the extremely valuable

Society of Automotive Engineers was formed; but the lumber industry, hoary with age, takes up the idea of a technical society only in its declining years. It is not yet too late to accomplish much. The past year's president, Mr. W. G. Collins of Fort Bragg, California, reëlected for another term, has advanced ideas of what the Conference can accomplish and his leadership should make the Fourth Conference next year an outstanding event in the sawmill industry.

Now that the logging and milling phases have something akin to technical societies, (incidentally they should eventually equal such societies as the A. S. M. E., A. S. C. E., and A. I. E. E. in technical and professional attitudes and standards) it remains only for the merchandising personnel to get together and form a similar organization. Not until then can the lumber industry be considered on the way toward complete modernization in the organization of its personnel.

EMANUEL FRITZ,
University of California.

British Wood Preservers Publish Journal

The new British Wood Preserving Association at the close of its first year began the publication of a journal to be known as the Journal of the British Wood Preserving Association. The contents of the first number which has just appeared contains verbatim reports of the lectures and discussions before the Association during the past winter, as well as a copy of the Association's constitution and the proceedings of its organization meeting in London, December 3, 1929. The editor hopes "that in the future the scope of the Journal will be enlarged to include original articles, reviews of current literature, and an account of the numerous other activities by which the Association is endeavouring to fulfil the purpose for which it has been formed."

The new journal is published by the Association at 166 Piccadilly Square, London, W. 1. The price to non-members is seven shillings and sixpence.

Pulpwood Consumption

The Bureau of the Census has issued a preliminary statement concerning the consumption of pulpwood and the production of pulpwood in the United States in 1930. The 1930 figure for pulpwood consumption reached the total of 7,155,588 cords. This is approximately 500,000 cords less than the consumption in 1929 and about 5,000 cords less than the 1928 figure.

The production of pulpwood in the United States in 1930 amounted to 4,610,408 tons as compared with 4,862,885 tons in 1929. The distribution between kinds of pulp was similar to that in 1929 with the exception of sulphate pulp which exceeded by 30,000 tons the 1929 record. Mechanical and sulphite pulp production were about equal at 1,500,000 tons.

Sulphate production has increased to 952,000 tons which is the all-time record of production. Soda pulp production remains at the level at slightly more than one-half million tons a year.

The consumption of the different kinds of pulpwood differs somewhat between 1929 and 1930. The use of jack pine, gum and slabs and sawmill waste were greater in 1930 than in 1929. The consumption of all other kinds of pulpwood, however, was under the 1929 record. This is par-

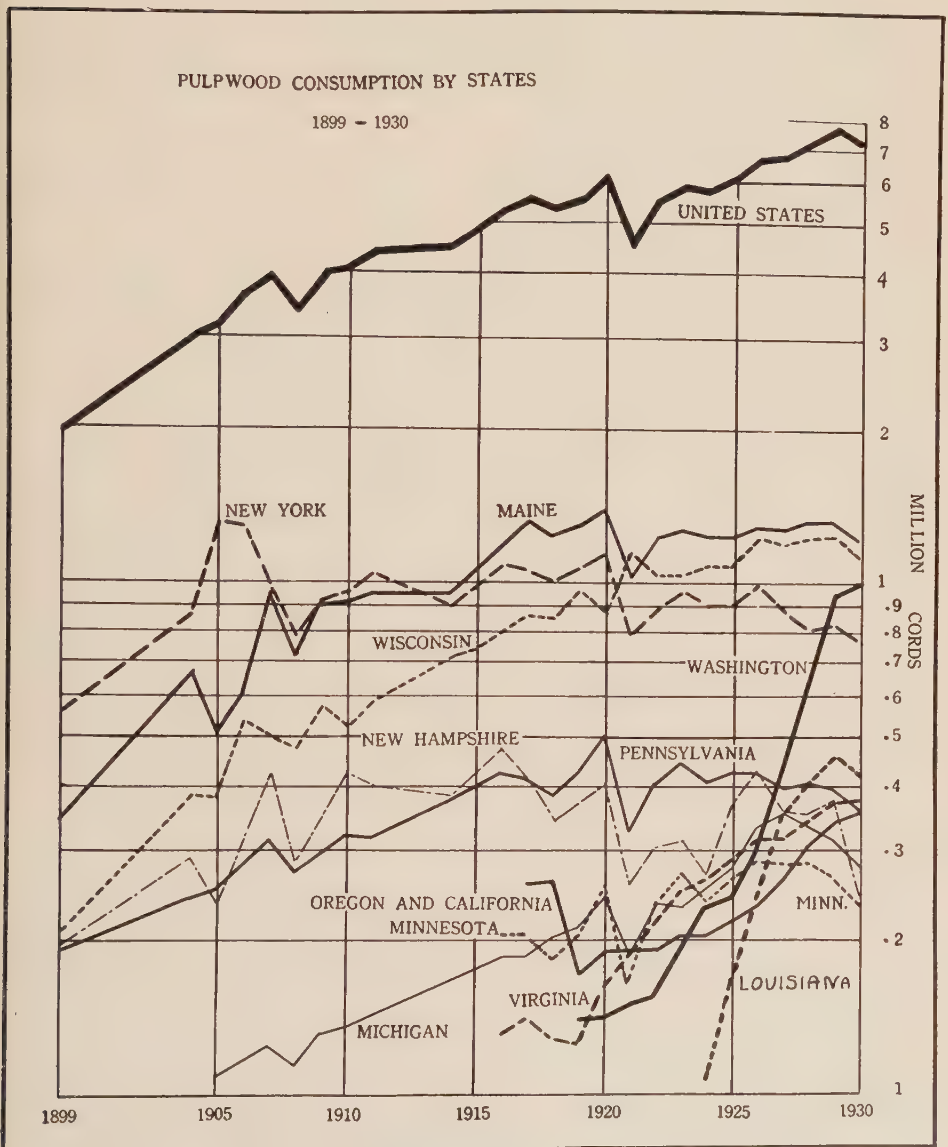


Fig. 1.—Trends of consumption of pulpwood by states from 1899 to 1930.

ticularly true in the case of spruce which dropped nearly 300,000 cords in 1930 as compared with 1929. The consumption of all kinds of pulpwood by states shows decreases in all states except Washington, Virginia, California and Oregon. The decrease was appreciable in Minnesota, New Hampshire and Michigan. Smaller decreases were registered in Maine, New York, Wisconsin and Louisiana.

In order that the consumption of pulpwood by states may be visualized, the trend of consumption for 1899 to 1930 are shown in a chart, Figure 1. These data indicate that pulpwood consumption has become stabilized in Maine, Wisconsin, Michigan and Minnesota; that it tends to decrease in New York, Pennsylvania and New Hampshire; and that it is increasing in Oregon, Washington, Virginia and Louisiana. The states which show increase not only make up for the decreased consumption in the states where the trend is dropping, but also add to the total consumption in the United States which has tended upward at a greater rate of increase since 1926. It is particularly significant, however, that the decreased consumption in the older paper-producing states is relatively slight. There are no sudden drops in the trends to new low levels, rather the declines are gradual, plainly of the variety that is governed by competition rather than by an abnormal shortage in pulpwood supplies.

It is important that the character of the state trends is thoroughly understood by the industry. The older producing regions are clinging tenaciously to their former levels of pulpwood use. The pulpwood needed to meet the greater demands for domestic pulp production is drawn from new regions. In addition, much pulp to meet domestic requirements is imported. The active competition in the pulp industry tends to be between the producer in the new regions and the importers.

From *Pulpwood,* August, 1931.

Ontario Forest Resources

The Ontario Forestry Branch of the Canadian Department of Lands and Forests has produced an excellent 60-page bulletin descriptive of the forest resources of Ontario. The text is by J. F. Sharpe and J. A. Brodie. The contents include chapters on factors affecting forest conditions, forest surveys, forest conditions by regions, a summary and an extended appendix with tabular material on the timber resources. Separate maps and charts are included in an envelope. The bulletin is unusually well printed.

Plan for Forestry Convention at Vienna Abandoned

Word received from Dr. J. A. von Monroy of the Deutscher Forstverein gives the information that the forestry convention which was to have been held in Vienna the past summer has not been postponed but definitely given up, evidently on account of the disturbed economic conditions in Europe.

REVIEWS

Forest Measurement. By Harold C. Belyea. *Pp. 319, Figs. 87. John Wiley & Sons, New York. 1931. $3.50.*

This is the first American text on forest mensuration to appear in ten years. Concerning the volume, one reads in the preface that, "To clear up the subject for easier digestion, to bring its methods up to date, to make it as brief and concise as possible without sacrifice of important detail, have been its major objectives. To this end it has seemed best to stick closely to the main theme and leave to others the further development of its ramifications and the advocacy of modifications."

The book is divided into fifteen chapters as follows: Introduction; Instruments used; Units of volume; Log rules; Measurement of volume-scaling; Determination of volume in standing trees; Determination of volume in forests; Application of statistical methods; Graphs and curves; Alignment charts and anamorphic curves; Form and taper; Volume tables; The age of forests; The study of growth; Yield of forests.

The first six chapters cover about 100 pages, but contain little that is new, either in content or in presentation. It is of doubtful merit that this, the third comprehensive American text-book on forest mensuration, should re-describe so many instruments, which had already been rather fully treated and illustrated in its predecessors, by Graves and by Chapman. A few principles of tree-diameter measurement, of height measurement, of log scaling, and then the use of an instrument to illustrate the application of each principle, should suffice for this part of an elementary text.

The author is inconsistent in dealing with the principles he does bring out in the first six chapters. For instance, he carefully derives the mathematical proof of the method of sines for use in hypsometering, but immediately thereafter states that it is not so practicable because the instrument with which it is to be applied is seldom suitably graduated for the purpose; whereas he does not at all derive the mathematical equation of the Biltmore stick, hence he fails to clarify the assumptions upon which this instrument, so universally used by American foresters, is based.

The chapters on the statistical method, on graphs and curves, and on alignment charts, depart from the standard outline of Graves' and of Chapman's texts. Unhappily, however, they do not lead to logical deduction of mensurational technique from the theory of probability or the principles of sampling. Indeed, with

the exception of that part which deals with rectilinear graphics, almost no subsequent application is made of the subject-matter of these chapters. This is to be regretted; for an understanding of certain elements of statistics might have followed had the author used the content of his chapter on the statistical method to show how certain every-day problems of the practising forester might be handled. For instance: Is a given scaling method sufficiently unbiased that fallers and buckers may be paid on a bonus plan? What is an acceptable error of ocular estimate of tree diameters in cruising? Is the Biltmore stick sufficiently reliable as a check of ocular estimates? Is ocular estimating of all tree heights more accurate and efficient than measuring comparatively few heights? If so, how many heights should be measured? How should they be measured?

The author chooses, however, to plunge the student of elementary mensuration beyond his depth, through an elaborate maze of alignment charts, anamorphoses, and into yield and stand table construction without adequate preparation. While it is well known that the application of the statistical method has added impetus to volume and yield studies, it is equally true that investigation along these lines is still the work of specialists.

Pedagogically, forest mensuration is admirably suitable as a vehicle for training in the scientific method. True enough, the practising forester is a professional man and not a scientist. But he is constantly called upon to draw conclusions and to devise methods as free from the personal equation as he can make them—in short to use the scientific method. Hence, if an understanding of necessary fundamental principles be developed in his college days, he will readily acquire the tricks of the trade as he accumulates practical experience in later professional life.

The book uncovers many tricks of the trade where it might have delved adequately into a few principles upon which the student should build for himself.

F. X. Schumacher,
Chief, Office of Forest Measurements,
U. S. Forest Service.

Forest Measurement. By Harold C. Belyea. *Pp. 319, Figs. 87. John Wiley & Sons, New York, 1931. $3.50.*

Teachers of forest mensuration, especially those who teach undergraduates by the text book method, should welcome Belyea's book. It brings together from many sources the up-to-date American mensuration methods. Fortunately, however, the author does not add to the difficulties of the subject by including all available methods.

The book may be divided into three major parts. The first part, which makes up about 40 per cent of the book, includes a general introductory chapter, a chapter each on instruments, units of volume, log rules, scaling, the determination of volume in standing trees and timber estimating. In the second part, which makes up 20

per cent of the book, the author digresses to discuss statistical methods, graphs and curves, alignment charts and anamorphosis. The third part is devoted to a discussion of form and taper, volume tables, and growth and yield. The contents of the book includes those subjects which should be included in a beginning course in mensuration.

The reviewer believes, however, that certain topics are over-emphasized and others under-emphasized. The outstanding case of over-emphasis is the chapter on charts and graphs. Relatively too much space is devoted to the discussion of the art of preparing charts for presentation. This space might have been devoted more profitably to a detailed discussion of the methods of properly fitting curves to raw data. Too much space, it seems, is also devoted to the discussion of the preparation of alignment charts for mathematical formulas and too little space to their application to empirical data. For instance, the author dismisses the application of alignment charts to the construction of volume tables by the following statement: "The alignment chart technique offers not so much a method of constructing volume tables as it does a manner of presenting volume tables already constructed." The applicability check of volume tables is not mentioned. More space might also have been devoted to a discussion of the methods of computing estimates. The reviewer was also greatly surprised to find that little or no mention is made of the work of Behre on form and taper. It would seem also that permanent plots deserve more space. The reviewer feels that the book might be improved by changing the emphasis of the different subjects.

With few exceptions, the chapters are well arranged. The chapters on statistical methods, charts, graphs and alignment charts, in the reviewer's opinion, might better have been placed in an appendix or at the end of the book, even though those subjects be studied in the order given. The reviewer can see no reason why the two chapters on tree form and volume tables were not placed before the chapter on timber estimating. As now arranged, the student studies timber estimating without a knowledge of volume tables as nothing on volume tables is given in the chapter on the determination of the volume in standing trees.

The readable style, the concrete examples and numerous figures make the first part of the book admirably suited to undergraduates. Unfortunately the chapter on statistical methods ushers in a difficult style which appears wherever the more difficult phases of forest mensuration are discussed. This, of course, only adds to the confusion of the student. The book as a whole would be improved if this difficult style were corrected.

Belyea's book is for the most part up to date, is neither too sketchy nor too all inclusive, is well illustrated, and therefore is the best American book on forest mensuration available for undergraduate use.

R. M. Brown,
University of Minnesota.

The Mechanical Properties of Wood. By George A. Garratt. *Pp. 276, illustrated, John Wiley & Sons, New York. 1931. $3.50.*

This new book, dealing with the mechanical properties of wood, is of interest to wood technologists and to users of structural timbers. The author has avoided unnecessary technical language in an attempt to make the book understandable to all who are interested in wood. The discussion has been divided into four main parts as follows: (1) The mechanical properties of wood, (2) Factors affecting the mechanical properties of wood, (3) Working stresses for structural timbers, and (4) Timber testing.

Part I of the book contains 51 pages and deals with the mechanical properties of wood. This includes a brief discussion of such properties as (1) tensil strength, (2) crushing strength, (3) shearing strength, (4) cross bending strength, (5) stiffness, (6) toughness, (7) hardness, and (8) cleavability.

No attempt is made to derive the formulas used in determining the various strength values. The formulas throughout are stated in their simplest form. It seems that the author might well have given some space to a discussion of the important basic formulae along with their application.

The statement under the diagrams on Fig. 13, page 28, is misleading. The middle diagram represents vertical shear and the lower diagram represents the bending moment. However, shear along the neutral axis is proportional to vertical shear and the compression at the upper surface (also tension on the lower surface) of the beam is proportional to the bending moment. No explanation of this fact is given in the text.

Part II of the book, from page 52 to 150 inclusive, deals with the "factors affecting the mechanical properties of wood." All types of defects too numerous to mention are discussed. In addition to defects, the author has included a discussion of other factors which affect the strength of wood, such as density, rate and condition of growth, moisture content, temperature, preservative treatment, heartwood and sapwood, live versus dead timber and season of cutting.

Part III of the book (51 pages) deals with "working stresses for structural timber." The different factors concerned in the derivation of safe working stresses are discussed and the method used in computing allowable stress values is explained.

Part IV relates the actual procedure in making timber tests. It includes a discussion of the factors, such as form of material, size of specimens, moisture determinations and type and speed of testing machines which must be taken into account in making strength tests. In addition a description of the various tests and the formulas used in computing the various strength values are also included.

The structural grades of American lumber standards and sample working plan for tests on small clear specimens are discussed in an appendix of twenty-nine pages.

The book brings together in one volume a vast amount of information

on the mechanical properties of wood. The book is well illustrated and all important data are given in table form. Numerous references are also listed. It is valuable as a reference book and also a text for forest school courses in the mechanical properties of wood.

L. W. REES,
University of Minnesota.

Field Book of Ponds and Streams. By Ann H. Morgan. *G. P. Putnam's Sons, New York. Pp. 448, 300 figures. 23 plates. 1930.*

This is an excellent presentation of a very broad field of life forms given from an academic viewpoint and of particular interest to students of general biology or individuals desiring to obtain a working knowledge of the life of ponds and streams. There is much material not observed elsewhere regarding some forms particularly the crustaceans and aquatic insects, the latter being treated in considerable detail.

While it could be difficult to treat all forms discussed in as much detail as some are treated, particularly the aquatic insects, in one volume, it is felt that the fishes deserve more attention than is given. The *Salmonidae,* most important from a recreation and commercial viewpoint of all fresh water fishes, are given one page, dealing with the charrs alone. While the Dolly Varden, or western charr, is mentioned, nothing is said of the western salmon with such interesting life histories. The discussions apply more specifically to the eastern United States, although in some instances western forms are discussed. It is an interesting and valuable introduction to the study of water life and foresters having an interest in this subject will find this book interesting reading and a valuable reference book.

S. B. LOCKE,
Intermountain Forest and Range Experiment Station.

The Fauna of Forest Soil. By C. H. Bornebusch. *Forest Research Proceedings of Denmark. Vol. 11: No. 1, pp. 224, illustrated. 1930. (Text in English with summary in Danish.)*

As early as 1879 P. E. Müller, the pioneer in the field of forest soils, called attention to the importance of earthworms and other lower forms of animals in the decomposition of forest litter and the modification of the physical condition of forest soil. He pointed out that one of the characteristics of his two major humus forms, "Muld" and "Mor" (raw humus), is the presence of earthworms in the former and their absence in the latter. Although the investigations and reports of Müller are more than fifty years old they are almost up-to-date, but he did not have available present day technique to support his statements.

Bornebusch, schooled from youth in Müller's findings, has now finished an intensive statistical study of the animals living in the Danish forest soils. This is the first comprehensive publication in existence in this field.

Bornebusch centered his investigations on typical humus forms, deep good mull, impoverished soil and raw humus, and gives full site descriptions supported by growth data and giving also the forest types according to his own floristic type classification (See *Disquisition on Flora and Soils of Danish Woodlands,* I-IX D.F.F. Vol. VIII 1923 and 1925). On these sites the litter, humus layers and upper soil horizons were collected from 1/10 sq. meter plots and brought to the laboratory where they were placed in large zinc funnels and the animals driven out by means of heat.

As would be expected the largest number of earthworms (23 to 177 per sq. meter) was found in the good mull, but 18 to 81 per sq. meter are found in the raw humus which is a surprisingly large figure as there are very few reports of earthworms in this humus form. The different species of earthworms are, however, very unevenly distributed in the different soil types. The large common earthworm (*Lumbricus terrestris,* Linné) also common in this country in rich fields and gardens, is found only in the very best mull soils. The most typical mull soil species is *Allolobophora turgida,* Eisen, while *Lumbricus rubellus,* Hoffmeister, also one of the most important forest soil species, is found in beech raw humus as well as in mull. The most common raw humus worm is the tiny *Dendrobaena octoedra,* Savigny. Potworms (Enchytraeidae) which occur in large numbers in raw humus as well as in mull are not included under the earthworms. Other animals: Gastropoda, Isopoda, Acarina, Collembola, Diptera and Chilopoda, Staphylinidae, etc., etc., are found in much larger numbers than the earthworms and occur, as a rule, most abundantly in raw humus (3,000 to 11,000 per sq. meter in mull while 11,000 to 20,000 in raw humus). The most abundant species is Acarina (mites) (1,000 to 10,000 per sq. meter) and Collembola (Springtails) (500 to 7,000 per sq. meter). Protozoa and Nematoda, of which there are immense numbers in the forest soils, were not measured.

In considering the weights of the different species of animals the author found that good mull greatly exceeds raw humus (mull: 38 to 77 grams per sq. meter. Raw humus: 10 to 24 grams per sq. meter). Spruce mull gives a very low figure (only 11 grams per sq. meter) and impoverished soil the lowest of all localities investigated (5 grams per sq. meter). The reason for this is the greater number of the heavy earthworms in the good mull—in the oak mull the earthworms constitute 61 grams of the total 77 grams per sq. meter. Bornebusch expresses these observations in the following law: "The soil in which decomposition is most active contains the greatest weight of animals, but the lowest number; where decomposition is slow, so that a heavy layer of raw humus is formed, we find the greatest number of animals but on an average these are very small and their total weight is lower than that of the best soil. In other words the good forest soil contains few and large animals, the inferior one many and small animals."

In attempting to find a better expression for the intensity of animal activity than that which the number of individuals and their total weight offer, a "Krogh micro-respiration apparatus" was used to measure the respiration, and it was found that the most intensive animal life occurs in the best mull, next comes beech raw humus in which it is much higher than in poor mull and in impoverished soils.

Bornebusch opens our eyes to a virtually unknown world in the forest which is of scientific interest as well as of practical value. The site quality depends to a great extent on the productive power of the soil and this again hinges partly on the quality, quantity, and degree of activity of the animal life in the soil. By good silviculture the right kind of soil fauna can be maintained or stimulated; and by poor silviculture it may be depleted.

It would be highly desirable to have similar studies made of the fauna of the American forest soils.

SVEND O. HEIBERG,
New York State College of Forestry.

Un Exemple du Developpement Progressive d'une Forét Jardinée de Sapin et d'Epicéa et de la Marche de son Accroissement. (An Example of the Development of a Selection Forest of Fir and Spruce, and the Progress of its Growth.) By H. Badoux. *Annales de la Station Fédéral de Recherches Forestières Vol. 16: 5-48. 1930. (German Resumé.)*

This article reviews in detail the results of twenty-four years of observations on a permanent sample plot of four hectares established in the Toppwald forest in the Canton of Berne, Switzerland. The purpose of the plot was to show the improvement of the stand and the increased growth which was brought about by the strict application of the selection system under the management of the experiment station.

The selection system is coming back into favor in much of Europe and the results are very interesting.

The forest at the beginning of the experiment was a mixture of fir and spruce, uneven-aged, and somewhat neglected. The spruce occupied a somewhat minor place. The cut had been less than the increment, resulting in too many trees of the larger sizes and too few of the smaller.

A careful inventory of the stand was made by the volume table method at the beginning of the experiment, and again after each of the cuttings which were made every six years. In this way the growth was determined.

The volume of the standing timber after each cut remained practically the same, showing that the cuts made were almost exactly equal to the growth on the plot. The number of stems has decreased 33 per cent but the average volume has increased from 0.78 cubic meters to 1.10 cubic meters per hectare. The quality of the stand has been improved by greater average

height, an improvement in the form of the individual trees and an increase in the number of beech introduced into the stand. The size of the trees in the remaining stand has been increased, the diameter limit increased, and the size of the trees cut increased. The introduction of beech has improved the quality of the soil.

The volume of the cut increased during the twenty-four year period from 10.3 cubic meters in 1906 to 12.3 cubic meters in 1929.

The results are very gratifying and should be of interest to the foresters of America where many of our forests lend themselves so well to management under the selection system, and where there is such a strong tendency toward the use of pure and even-aged stands.

E. G. Cheyney,
University of Minnesota.

Die Strahlung und ihre Bedeutung für das Klima. (Radiation and its Climatic Significance.) By J. Bartels. *Zeitschrift für Forst- und Jagdwesen. Volume 62. No. 7-8. Pp. 537-563. 1930.*

This article constitutes a technical consideration of the various elements of radiation with respect to the general effect upon the physical aspects of climatology. The subject is considered in three chapters, (a) general physical principles, (b) sources of radiation for the earth, and (c) application to meteorology. It should be of interest to all foresters, who, as a rule, are rather poorly informed in meteorology, in spite of its significance for a complete understanding of any branch of ecology.

Except for an occasional reference to the influence of plant growth upon radiation and reflection, the author has not presented the subject from a biological angle, as this may be associated with the idea of forestry. While some of the discussion is rather technical, in general, it is easily readable for anyone having an elementary understanding of photometry and descriptive meteorology. The sections dealing with terrestrial and atmospheric radiation and selective absorption capacity of atmospheric gases are particularly interesting.

A bibliography is included.

J. Roeser, Jr.,
Rocky Mountain Forest Experiment Station.

Pitch Pine in Pennsylvania. By Joseph S. Illick and John E. Aughanbaugh. *Dept. of Forests and Waters Res. Bull. 2. Pp. 108, illus. Harrisburg, Pa. 1930.*

This bulletin is a very thorough silvical study of pitch pine in the State of Pennsylvania. In it the pitch pine is pictured a hardy, fast growing and intolerant tree. Resistant to drought and fire, not averse to shallow soil and capable of growing at various altitudes on light, barren, sandy locations, it appears an almost ideal tree for the reforestation of waste lands which would otherwise be non-productive.

A protection forest on the poorer mountain slopes, it forms a good production forest on the better sites, producing yields as high as 20,000 feet to the acre and individual trees two feet in diameter and a hundred feet high.

Add to these characteristics its ability to form merchantable sprouts from trees at least two inches in diameter, its heavy seed production at an early age, and the facility with which successful plantations can be obtained by the use of two-year old seedlings, and the pitch pine appears as a very important factor in the future of Pennsylvania forestry.

The tree has a few faults. It breaks rather readily under snow pressure, due to its heavy, closely bunched foliage and is so intolerant that it maintains a pure even-aged stand with difficulty and has trouble in growing in mixture with more tolerant trees, but these are minor difficulties and will doubtless be overcome in the more intensive forestry of the future.

The bulletin is well done. If we had such a study of each of our commercially important species, the handling of our American forests would be greatly simplified.

E. G. CHEYNEY,
University of Minnesota.

Der Russische Steppen-Waldbau (Russian Steppe Silviculture.) By E. Buchholz. *Zeitschrift für Forst-und Jagdwesen. Vol. 62, No. 4, 1930. Pp. 233-241.*

In the minds of foresters, as a general thing, the practice of silviculture is intimately associated with forest stands. Occasionally we encounter a situation which demands a rather broad interpretation of the term in order to associate it with what may be termed a "quasi-forest" condition. Such a one is found in the steppe region of European Russia, a territory of considerable importance in the political economic life of the Soviet Republic, because of its very extensive area.

The article is an historic account of silvicultural development, mainly in its relation to afforestation, within this region, and this review confines itself to a non-critical interpretation of the same. Because of the natural obstacles which it has been and still is necessary for the forest planter to surmount, and the evident assiduousness with which the job of planting has been tackled in this region, the account should be of interest to American foresters.

Destructive forest exploitation since the beginning of the World War and reaching its culmination between 1917 and 1922 has resulted in a 30 per cent reduction of the thinly forested area within the forest steppe region of the southern portion of the Soviet Union. The consequences have been rather serious, both from a social as well as from a physical-economic standpoint, the latter mainly in relation to ground water and erosion conditions. A renewal of the planting program abandoned with the war is, therefore, greatly to be desired.

The history of Russian steppe af-

forestation dates back to the time of Peter the Great (1696). The most outstanding planting results were obtained by the German Mennonite colonists who settled in this region in 1830. Prominent among the pioneers in establishing steppe silvicultural practice were the brothers Kornis and a certain Hahn whose planting methods were accepted as basic for later fiscal afforestation endeavor. The first government experimental forest range was established about 1841 near Mariupol under the supervision of von Graff. Three of the five experimental planting objectives assigned to von Graff have in whole or part been attained but not the other two, particularly that relating to the influence of the forests of the steppe upon climate. Maximum activity came in the years between 1880 and 1890. Following the drought years of the nineties, general planting operations dropped off, but increased development was experienced in the establishment of small wind breaks. During the course of years, a unique, comprehensive, but little known literature has been built up on the subject of steppe silviculture.

The steppes of European Russia cover approximately 580,000,000 acres, or about 47 per cent of the European area of the U. S. S. R. The climate is continental, being characterized by severe open winters, short springs, and wide temperature fluctuations. Precipitation averages about 16 inches, and drought periods occur frequently. Strong dry south and southwest winds are prevalent.

The soil is a black earth (Tschernosem), resting on loess. The upper layer of two to four cms. consists of turf. It rests on Horizon A, a dark soil, 30 to 60 cms. deep, of conglobatic structure. Horizon B is 40 to 80 cms. thick, lighter in color and firmer in texture. Horizon C is yellowish and represents the very deep loess subsoil. Between two to five meters, a dark humus layer occurs. The presence of carbonate of lime beginning at 40 to 50 cms., is a characteristic quality of the steppe soils. Toward the southeast, the general composition of the soil changes gradually into the chestnut and brown soils of the dry steppe region.

Forests on the steppes are encountered mostly on divides and in dry stream beds, ravines, etc., where more or less definite leaching out of the soil has occurred. Under artificial reforestation, which at best, is difficult, the black soil gradually degrades in 30 years into a gray forest soil.

The vegetation is quite unique, consisting mostly of grasses having a short vegetative period, capable of withstanding prolonged drouths and accommodating themselves to a certain degree of salinity. The plant life varies throughout the steppe region with moisture conditions. In the north, on the border of the forest steppe, is found the so-called meadow steppe. Characteristic plant genera here are *Poa, Triticum, Hierochloa, Caragana, Prunus, Amydalus* and *Spirea.* On the dry steppe of the south and southeast, the vegetation assumes a semi-desert character. Festucas are the prominent grasses, and on alkaline sites, *Arte-*

misia, Pyrethrum and *Kochia* are encountered.

Afforestation of the steppe is contranatural and possible only at heavy cost. Von Graff succeeded in developing 370 acres of cultures into forest stands. The technique employed was very intensive. The soil was plowed under four times in two years and was planted in the spring of the third year by the deep hole method, employing a 6.9 foot spacing. Five- to six-year-old plants were used. Ash was the principal tree planted, but upwards of 50 per cent of oak, elm and honey locust were also started. Cultivation operations were continued after planting. The costs were enormous ($134 per acre as nearly as can be determined), in spite of extremely cheap labor. The freeing of the serfs in 1861 resulted in the loss of this cheap labor and a cessation in planting activity.

Von Graff's successor, Barck, concentrated upon the elms, and to a certain extent, upon the oaks and acacia. He reduced costs to approximately one-fourth of the Von Graff standard, and extended the plantations appreciably.

Following the drouth years of 1891 and 1892 a scientific expedition under the soil scientist Dokutschajew was organized to study methods and means for combatting the evils of drouth damage. Wyssotzki, a member of the expedition, conducted a series of investigations which assisted materially in clarifying the physical requirements of forest growth on the steppes. He recommended the establishment of wide-spaced stands, consisting of relatively short trees with low, wide crowns and the concurrent introduction of shrub species as an understory. His technique, which constitutes the existing basis of steppe silviculture, considers the oak as the principal species, secondary species being Norway maple, ash, linden and other indigenous trees.

Two planting systems are recognized. In the first, each plant of the principal species is alternated with one plant of the understory (Tataric maple, buckthorn, woodbine, yellow acacia), while in the second, two silviculturally different groups of small shrubs including dogwood, spindle tree, tamarisk, and others are planted in place of the one species of the other system. The spacing employed between trees of the upper story is 5 x 4 feet. By judicious distribution, all silvicultural demands in connection with soil protection and nurse crop may be fulfilled. Approximately 4,615 plants are used per acre, of which one-half are shrubs when the first system is employed and two-thirds in the case of the other system. The stand closes itself in from four to five years. The cost of such planting before the war was $14.00 to $16.00 per acre.

In 1908 a commission, under Wyssotzki investigated conditions affecting the poor condition of many stands, the dying-off of extensive areas, the appearance of pests, etc., and recommended that future planting be confined to definite areas having a low concentration of salts and more or less suited to forest growth. In the end, planting was confined to shelter-belt strips. With the founding of an ex-

periment station in 1925 at Charkow (Ukraine) under Wyssotzki, new afforestation measures were defined which have as their immediate objective the planting of 7,400 acres of shelter-belt rows.

J. Roeser, Jr.,
Rocky Mountain Forest Experiment Station.

Bericht der Waldsamenprüfungsanstalt Eberswalde im 30. Jahre ihres Bestehens, und Prüfungsbestimmungen für Forstsaatgut. (30th Report of the Forest Tree Seed Testing Station at Eberswalde, and Testing Rules for Forest Seed.) By Prof. Dr. Werner Schmidt. *P. 24. J. Neumann, Neudamm, 1930.*

Seed-testing and research have become much more thorough and intricate since the founding of the station under Prof. Schwappach. Now mere purity and germination tests are not enough, but every effort is made to ascertain the causes of poor quality. Only in recent years has the importance of after-ripening treatment for forest tree seeds been appreciated. The investigations of Grisch and Lakon (1) on white pine and Barton (2), (3) on various conifers have shown that previous poor germination results were often due to improper storage prior to the germination tests. In the modern seed control station such factors cannot be neglected. Studies of seed ferments have also become valuable aids in showing the condition of seeds, and determinations of catalase activity are now regular features of the Eberswalde routine. These tests are also valuable aids in determining the degree of maturity, and to an increasing extent in indicating the origin of the seed. Investigations on the effect of the time of collection on the keeping qualities of the seed have shown that birch should be collected as late as possible, and that scotch pine collection should start about November 1st.

Another field of interest has been the improvement of extraction technique, aiming to raise the quality of the seed. The present tendency in seed extraction plants, as recommended by Romell (4) and Bates (5) is toward decentralization, and the use of small extractors whereby each forest unit, or owner can extract his own cones for local use, and thus be sure of seed of suitable origin. A further argument for the small local plant is the reduction of freight costs on shipping green cones long distances. Heretofore small plants have been relatively more expensive to operate, as well as yielding a much inferior product. The Waldsamenprüfungsanstalt has done much to develop small, economical, portable extractors, as well as cheap hand-operated wingers. Progress has also been made in Sweden in constructing small unit extractors, using a progressive system (6). The most notable improvement in cleaning technique worked out at the Eberswalde station has been the fractionating of a mixture of empty and full seed by a vertical air current, much like the fractional distillation of a mixture of two liquids of different specific gravities.

Such procedure has increased the viability of commercial lots of European larch seed from 40 to 50 per cent to 90 per cent, and of white birch (notoriously poor in quality) to 95 per cent.

Foresters are now following the lead of agriculturalists in making the final test of seed and the plants it produces. At Eberswalde more and more, efforts are being made to complement the physiological tests on seeds of local races (cf. Schmidt (7), (8), (9), by controlled field sowings.

An important part of the present report is the inclusion of the detailed rules for seed-testing in use at the station. The periods for germination tests on the Jacobsen apparatus have been shortened to 21 days for *Pinus silvestris, Picea excelsa, Betula* and *Alnus,* as compared to previous rules (10); *Pinus nigra, Pseudotsuga taxifolia* and *Abies pectinata* are run 42 days, and *Larix* and *Quercus* 28 days. It seems surprising that the period for *Pinus strobus* has been lengthened to 90 days, in view of the general knowledge of its after-ripening behavior. The reviewer has obtained complete germination of very refractory samples in from 20 to 30 days after one month's preliminary stratification.

The present technique of the germination test includes the testing of three duplicate samples of 100 seeds each, not only on the Jacobsen apparatus, but frequently also on pulp blocks, clay plates or in sand. A constant temperature of 25° C. is used, although alternating temperatures are admittedly better for some species. A moisture content of 60 per cent is stated as optimum, but this is difficult to obtain in many cases; in fact it would seem to be the factor in all seed testing most in need of better control. The statement that light is "indispensable for complete germination" of scotch pine and larch, while darkness may be beneficial for spruce seed germination, is an interesting contribution to the much disputed question of the influence of light on germination of tree seeds.

Other tests which the station carries out on special request are investigations of the origin, genuineness, water content, condition of the seed coat, soundness of the seed and degree of ripeness. Due to the accumulation of empirical data from many catalase determinations, the station is now able to offer advance reports on the viability of scotch pine 2-3 days, and white pine 10-15 days after the receipt of the sample.

Standards for tree seed are constantly rising. As an example it is stated that the Council for Seed Certification in coöperation with the German seed extracting plants, nurserymen and seed dealers has ruled that no scotch pine seed shall be sold as "first class seed" unless it has a purity of at least 98 per cent and a germinative speed of 90+ per cent in 7 days. Guarantees of purity and germination, based on tests are allowed the following variations:

Purity	Variation
97 per cent and over	±1 per cent
90-96.9 per cent	±2 per cent
less than 90 per cent	±3 per cent

Germination

90 per cent and over	±2 per cent
80-89.9 per cent	±3 per cent
less than 80 per cent	±4 per cent

Formulae for calculating the price of seed which deviate from the standards of purity and germination are also given.

REVIEWER'S REFERENCES

1. Grisch und Lakon. 1923. Die Keimprüfung des Weymouthskiefernsamens. Landwirtschaftliche Jahrbucher der Schweiz.
2. Barton, L. V. 1928. Hastening the germination of some southern pines. Jour. For. 26:774-785.
3. ———. 1930. Hastening the germination of some coniferous seeds. Am. Jour. Bot. 27:88-115.
4. Romell, L. G. 1926. Sveriges skogsfröförsörjning. Skogen 13: 115-132.
5. Bates, C. G. 1929. Some problems of seed production, collection, and distribution. For. Chronicle 5: 17-29.
6. Baldwin, H. I. 1930. A new seed-extracting apparatus. Jour. For. 28:92-94.
7. Schmidt, W. 1926. Herkunftsbestimmung bei Kiefernsamen. Silva, No. 30.
8. ———. 1929. Die physiologische Keimungsdiagnose. Proc. Cong. Inter. Union of Forest Research organizations. Stockholm.
9. ———. 1930. Unsere Kenntnis vom Forstsaatgut. Berlin.
10. Landw. Versuchsta. 1917. 84: 364-408.

HENRY I. BALDWIN,
Brown Corporation,
Berlin, N. H.

Forest Types of the Northern Rocky Mountains and Their Climatic Controls. By J. A. Larsen. *Ecology 11: 631-672. 1930.*

The altitudinal zonation of forest types with their distinct variations in climatic characteristics, particularly in temperature and precipitation, is a vegetational feature in the western United States which has long attracted study and investigation by forester and botanist. Foresters will be interested, therefore, in this report which describes the forest types in Montana and northern Idaho, points out their natural distribution and chief silvical characteristics and indicates in what degree they are controlled by differences in topography and climate. The report is particularly interesting as the northern Rocky Mountain region, with one or two notable exceptions, has been largely neglected by systematist and ecologist alike in spite of its many attractive topographic and floristic features.

One of the main contributions of the report is a map showing the occurrence and altitudinal zonation of the five major forest types of the region. This map (unfortunately reproduced on such a small scale as to obscure all but its major features) was compiled chiefly from silvical reports and

type maps on file in the Region 1 offices of the United States Forest Service, necessarily correlated and supplemented in many places by the author who is well fitted for this task by 14 years' experience and extensive travel in the region.

In discussing the vegetational features Larsen first divides the region into three main topographic units (1) Washington and Idaho to the west of the Bitterroot Mountains (used here as a generic term to include not only the Bitterroots proper but the Coeur d'Alene, Cabinet, Purcell and adjacent ranges as well), (2) the Flathead and Bitterroot Valleys lying between the Bitterroot Mountains and the Continental Divide, and (3) central Montana east of the Continental Divide. Larsen recognizes five principal associations in the unit west of the Bitterroots and three in each of the others. Each association is described in detail as to floristic composition and silvical requirements and their principal climatic characteristics are tabulated. These tabulations are chiefly monthly, seasonal and annual summations of temperature and precipitation records compiled from the printed reports of the United States Weather Bureau and from some records gathered by the Forest Service on summer meteorological conditions on mountains. Whenever possible at least five weather stations were chosen for each type and an effort was made to have one at either altitudinal extreme. Unfortunately the number of available stations in some types is extremely limited.

These meteorological records show adequately the distinct differences between each of the principal forest types. Table 1, compiled from the author's summary, shows the approximate range of average annual temperature and precipitation within each such type.

Larsen concludes from a general examination of the altitudinal zonation of the principal forest types and their silvical and climatic characteristics that the limits of each association are fixed chiefly by air temperature and precipitation, the downward extension of the type being limited by deficient precipitation, the upper by deficient temperature.

Larsen's article is a welcome contribution to our knowledge of plant life and environmental conditions in the northern Rocky Mountain region. His treatment of the vegetation by natural units and his emphasis of important habitat characteristics and their influence on type distribution brings not only a fresh viewpoint (the late Dr. Kirkwood's more elaborate treatment of forest distribution in the same region having chiefly emphasized other features) but furnishes in addition information of direct value to the forester whose silvicultural practices can only succeed through a proper understanding of these habitat conditions and their ecological importance.

But although Larsen shows beyond reasonable doubt that each forest type grows under decided and different temperature and precipitation conditions he does not present any experimental evidence to support his conclusion that these factors are the controlling ones. It is true that other

investigations in mountainous regions point to temperature and precipitation as limiting factors. But the elaborate nature of these studies and the somewhat tentative and not always uniform results obtained all show how extremely difficult it is to evaluate properly the relative importance of each habitat factor in influencing and controlling plant distribution. The work of Bates, Pearson and Clements, to name investigators best known to foresters, and particularly the more recent studies in which extensive use has been made of phytometers and experimental vegetation amply serve to emphasize this viewpoint. The reviewer feels, therefore, that while the rôle played by temperature and precipitation is probably a very important one and quite possibly the dominant one, the subject is too complicated to be decisively settled for the northern Rocky Mountain region without careful consideration and experimental study of the many other habitat factors involved.

Some question might also be raised as to the rather loose usage employed by the author in referring to the five principal forest types as climax associations or permanent tree types. This term is aptly applied to the western yellow pine and cedar-hemlock types which are accepted by most ecologists as true climax associations. But it is not accurately used in referring to such units as the sub-alpine type, which may contain several climax and sub-climax associations or to the larch-Douglas fir and lodgepole-Douglas fir types which the author himself indicates would be replaced by somewhat different combinations in the course of natural, uninterrupted succession.

I. T. Haig,
Northern Rocky Mountain Forest Experiment Station.

Table 1

APPROXIMATE RANGE OF TEMPERATURE AND PRECIPITATION

Type	Range of average annual temperature	Range of average annual precipitation
	Degrees F	Inches
Western yellow pine	44 to 50	17 to 22
Larch-Douglas fir	40 to 45	20 to 30
Cedar-hemlock-white fir	40 to 45	27 to 44
Lodgepole-Douglas fir	35 to 40	20 to 25
Sub-alpine	30 to 35	24 to 36

CORRESPONDENCE

Forest Fires in the Mississippi Bottomlands

Editor, Journal of Forestry,

Dear Sir:

The May, 1931, issue of the Journal of Forestry carries an article by G. H. Lentz entitled "Forest Fires in the Mississippi Bottomlands" which contains too many erroneous implications to allow it to pass unchallenged.

In the region discussed by Mr. Lentz the article probably would do little harm to the "foresters and timbermen generally" who are included in his indictment. Outside the region, however, some of the statements may be taken literally as the calm, dispassionate utterances of a trained investigator. The result would be to establish the belief in the minds of readers that after all these years of public forestry activity in the South there is only one man there who really recognizes the need of fire protection in the bottomland hardwoods and that, to use Mr. Lentz's own words, "for the most part he has been unheeded like one crying in the wilderness." I do not believe that the foresters who are involvėd in this indictment will plead guilty; nor are they likely to concede to Mr. Lentz the lonely preëminence he claims in this particular field.

It is true that millions of acres in the bottomland hardwood type are unprotected. It is also true that many millions of acres of pine lands are unprotected. Only 23 per cent of the total forest area of Louisiana, Mississippi, and Texas, including both pine and hardwoods, is under some degree of organized protection. A substantial portion of the protected area consists of bottomland hardwoods. A number of hardwood owners in Louisiana and Arkansas are paying hard cash for fire protection in the hardwoods.

It is not difficult to understand why protection of hardwoods lags somewhat behind the protection of pine lands. It has been much easier in the case of pine to show the land owner the probability of an early return on his investment and since *intensive* protection in the southern states can be undertaken only where the owner is prepared to pay at least half the cost it was to be expected that fire protection would develop more rapidly in the pine areas. However, in those states like Texas, Alabama, North Carolina, and Virginia where the available funds have been used on an extensive system, that is to say, have been spread thinly over most of the state without waiting for private coöperation, the hardwoods have been protected along with the pine without discrimination. It should be understood that in Louisiana the state assumes no responsibility

for fire suppression on areas where the owners are not contributing funds for the work and the unattended fire mentioned by Mr. Lentz no doubt was on a non-coöperating area. If not, I am sure the State Forester would be glad to have the facts brought to his attention.

The statement that "Most of the state foresters in the South still make up their protection plans, solicit funds for fire prevention and suppression from pine timberland owners and allocate the funds obtained under the Clarke-McNary Act entirely on a basis of protection of pine lands" does not square with the actual facts. In my own experience I do not know of a case where the state foresters have discriminated against the hardwoods. Indeed they have worked hard to bring the hardwoods under a protection system. The main difficulty has been in getting facts as to values and damage which would be convincing to the owners. Recognition of this difficulty by State Forester Hine of Louisiana in 1927 led to the employment of Mr. Lentz in 1928 to make hardwood investigations and this was his first contact with the problem. The present State Forester of Louisiana, Mr. V. H. Sonderegger, has been an enthusiastic chamption of hardwood forestry and fire protection for a number of years and if there is any particular point in having a father of bottomland hardwood forestry, he shall get my vote.

With the limited funds available for fire protection—and appropriations are not being increased much these days—every responsible fire protection agency must face the problem of deciding where the investment will buy the greatest return. Fire suppression costs in the bottomland hardwoods during the occasional dry years are tremendous. The return may or may not be as great per dollar spent as in the case of pine land protection. The question can be answered only when we have *facts* as to values and damages. A few facts will be worth more than any amount of generalities.

Yours very truly,

C. F. Evans,

District Inspector, U. S. Forest Service, Asheville, N. C.

SOCIETY AFFAIRS

More About the Annual Meeting

The Jung Hotel has been assigned to the Society as its headquarters' hotel for the annual meeting in New Orleans, December 29-31. All sessions of the Society's meeting will be held here.

Meetings of the American Association for the Advancement of Science and affiliated societies are meeting in the Tulane University buildings.

The Jung Hotel rates are, Single, $3.50; Double, $5.00; Twin Beds, $6.00. All rooms are with bath.

Rates at other hotels for similar accommodations are as follows:

Hotel	Single	Double
Bienville	$3.00-3.50	$4.50-6.00
DeSoto	2.50-3.00	3.50-5.00
LaSalle	3.00	4.00-5.00
Marberc	3.00-3.50	5.00-6.00
Monteleone	3.00-3.50	5.00-6.00
Roosevelt	4.00-6.00	6.00-9.00
St. Charles	3.00-5.00	5.00-7.00

Headquarters of the American Association for the Advancement of Science will be in the Roosevelt Hotel. Registration fees for non-members of the A. A. A. S. will be $2.00. This fee entitles delegates to the reduced railroad fare of a fare and a half for the round trip. This rate will apply only on tickets which have been stamped by the railroad ticket agent at the place of purchase as being purchased for the purpose of attending the meeting.

A two hour trip along the New Orleans river front has been arranged for the delegates to the Society of American Foresters meeting. Entertainment is being arranged for the ladies. The all day field trip to Bogalusa, La., to see the forestry work carried on by the Great Southern Lumber Company, and also to inspect their mill, will be made by automobile from New Orleans, December 31st, returning to New Orleans by 7:00 or 8:00 P. M.

Make your hotel reservations now and notify Chairman G. H. Lentz that you are planning to attend the meeting.

Committee on Meetings,
G. H. Lentz, *Chairman.*

Proportional Representation and Society Elections[1]

Some three years ago when the Society's Constitution was in process of revision, the respective merits of proportional representation (P. R. for short) and sectional representation (S. R. for short) were thoroughly analyzed and P. R. was chosen in

[1]This article was prepared at the request of President Redington, and is particularly timely in view of the forthcoming Society election.

Editor's Note: The author comments also on the resolution of the Allegheny Section favoring sectional representation (see Journal of Forestry, May, 1931, p. 857).

preference to S. R. because, plainly, it would much more fully meet the very needs so clearly expressed in the Allegheny Section's list of "whereases".

P. R. is neither difficult of comprehension nor of execution. To grasp it requires less than one-tenth of one per cent of the time needed to understand some formula for computing compound interest, concerning which no one of our members would admit his mental incompetency.

P. R., to date, has been used by the Society but once;—in the election of 1929. If this election failed to put in office a President, Vice-President, and four regular members of the Council who do not truly represent the organization as a whole or its several component parts, the fault lies, not with P. R., but rather with the neglect of the members and the several Sections to take advantage of the opportunities which the system affords.

P. R. for its full success is predicated on a nomination slate made up from nominations-by-petition. A Committee on Nominations exists largely for the purpose of filling in blanks in the slate caused by an insufficient number of nominations-by-petition. If every Section, or group therein, would nominate by petition its "favorite son", the slate would be full and the Committee would be relieved of the responsibility of guessing more or less blindly what men the Society would like to see put forward as candidates. Its duties would be limited, as they should be, to the perfunctory announcement of the slate.

A slate made up thusly—and some Sections have already taken such steps for the 1931 election—provides a list of names among which every member of the Society can find one whom he would be glad to vote for as his first choice, and support as President. It provides further a fair opportunity for every "favorite son" to try his strength, and to depend for election, not solely upon the votes from his own Section, but also from supporters in other Sections. Without such outside support, as under S. R., he could hope only for election to the Council; with it, he has an even chance for election to the Presidency or Vice-Presidency. The outcome is dependent on his general popularity throughout the Society, and that is as it should be. Surely no faction of the Society is politically so sordid as to want to crowd into office by sharp tactics some pet of its own who would not be welcome to the Society as a whole.

The Society of American Foresters, of course, is a democratic body and free to use any method of election it sees fit. Before, however, it decides to abandon P. R. in favor of S. R., every member is earnestly urged to familiarize himself with P. R. and as to S. R., take into account not only its advantages, but also its drawbacks. If he does this, and it is very easy to do, he will, I am sure, finally decide in favor of P. R.

SOME OBJECTIONS TO SECTIONAL REPRESENTATION

First, the Council would be unwieldy; meetings would be expensive and difficult to arrange and there

would be untold delay in getting action by mail. Inevitably the expedient would have to be adopted of delegating to an executive committee within the Council most of the powers of the Council. The presumed advantages of Section representation would thus largely be lost since all Sections could not be represented on the executive committee.

Moreover, Sectional representation would not after all effect true representation. Our Sections vary in voting membership from 24 to 219, as of July 15, 1931. The Allegheny Section tried to meet this by proposing to weight the vote of each Council member in proportion to the voting membership of his Section. This the Gulf States and Ozark Sections—the two smallest sections—objected to in their resolutions. They naturally wanted each Section representative to have an equal vote. Even with a weighted vote, the weight would be constantly changing and complicating. Not only that but there would tend to be constant pressure on the Council to boost the election of new voting members in order to put more weight behind this or that section representative.

Finally, within any district, however small, the personal interests of the voters are exceedingly diversified and not infrequently conflicting. A Sectional delegate to the Council, elected by the majority or perhaps plurality of his Section, would represent only the majority or plurality sentiment of his Section, when the opinion of those out-voted might be very nearly as strong or even stronger and if united with similar opinion in other Sections might really represent the majority opinion of the Society as a whole. P. R. would take care of such conflicts of opinion under any and all circumstances by giving them proportional representation.

ANALYSIS OF 1929 ELECTION

To show to what extent the electors took the opportunity to vote sectionally the candidates have been grouped[2] accordingly, except for Redington.

---

[2]For this purpose the Sections and membership were grouped as follows:

The eastern group comprises the New England Section with 112 ballots cast (59.9 per cent voting), Allegheny, 91 ballots (53.8 per cent); New York, 80 ballots (63.0 per cent); and Washington, 70 ballots (70.7 per cent); total 353 ballots (60.7 per cent voting).

The western group comprises the North Pacific Section with 93 ballots (52.2 per cent); California, 70 ballots (46.7 per cent); Northern Rocky, 63 ballots (53.8 per cent); Central Rocky, 54 ballots (56.3 per cent); Intermountain, 36 ballots (64.3 per cent); and Southwestern, 15 ballots (42.8 per cent); total 331 (52.4 per cent).

The southern group comprises the Appalachian with 54 ballots (88.5 per cent); Gulf, 25 ballots (59.9 per cent); Southeastern, 19 ballots (42.2 per cent); and the Ozark, 13 ballots (54.1 per cent); total 111 ballots (64.5 per cent).

The midwest group comprises the Ohio Valley Section, 48 ballots (62.2 per cent); Minnesota, 30 ballots (50.8 per cent); and Wisconsin, 25 ballots (49.0 per cent); total 103 (55.4 per cent).

The Canadian ballots totaled 28 and all others 8, together with 36 ballots (61.0 per cent).

The total vote 934 represented 57.6 per cent of the voting membership, based on the JOURNAL tabulation of April, 1931, p. 642.

The "first choice" column immediately following the names of the candidates on the "result sheet," Table 1, shows how the total of 934 valid ballots was first distributed.[3]

It should be noted that the total vote for all candidates in each of the geographic or regional groups is as follows: general, 237; western, 253; eastern, 161; midwestern, 115; southern, 105; and Canadian, 63. Now compare this distribution with that in Table 2 made according to the regional origin of the ballots, viz., eastern, 353; western, 331; southern, 111; midwestern, 103; Canadian, 28; and others (Alaska, Hawaii, Philippines, etc.), 8. Furthermore Table 2 shows that of the eastern ballots only 108, or 31 per cent, went to the two regional candidates on first choice, while 95, or 27 per cent, went to Redington and the remaining 42 per cent to candidates in other regions. Similarly of the western ballots 161, or 49 per cent, went to the three regional candidates; 78, or 24 per cent, to Redington, and the remaining 27 per cent to the candidates in other regions. Of the other regions having candidates, the South gave 38 per cent of its votes to its regional candidates on first choice, the Midwest, 26 per cent, and Canada, 50 per cent. Thus, on the basis of first choice votes there does not seem to be much evidence of any rampant sectionalism, viz., 352 votes altogether out of 934 or 38 per cent.

Considering the individual candidates there is, however, somewhat more evidence of apparent sectionalism, though this is probably more apparent than real. A man, unless exceptionally widely known, as Redington, inevitably has a larger circle of acquaintances where he lives than elsewhere. Thus Guthrie and Show each drew about three times as heavily from the West as from the East. With Hosmer it was the reverse, while Howe and Tillotson were even more largely elected by eastern votes.

With 934 valid ballots, and 6 positions to be filled, it required one-seventh of that number, or the next largest integer, to elect each member, namely, 134 votes; called the *quota.* That being so, Redington had 103 votes more than his quota. Accordingly, he was declared elected to the Council on the first choice, and 103 ballots were taken away from him and each given to the candidate marked second choice thereon. The column headed "Transfer of surplus ballots of No. 1" shows how the various other candidates benefited by this transfer. Thus 45 altogether went to the western group of candidates, Show getting the most, while 28 went to the eastern group and the remaining 30 scattered among the candidates in the several other groups. It will be noted that these accessions gave Guthrie and Show in the West each a substantial boost toward the attainment of their quotas, likewise Hosmer in the East.

Next, looking at the "result" column

[3]Notwithstanding the unfamiliarity with P. R., it is interesting to note that there were but 9 invalid ballots, because improperly marked. One western voter, however, "refused to vote by any such fool system", while 19 other members failed to sign either the ballot or ballot envelope, as required for checking as to their good standing.

TABLE 1.

HARE SYSTEM OF PROPORTIONAL REPRESENTATION

Result Sheet

Number of Seats: 6

Body Elected: COUNCIL
Date: DECEMBER, 1929.

$$\text{Quota of Constituency}\left\{\frac{\text{No. of Valid Ballots} +}{\text{No. of Seats} + 1}\right\} = \frac{934}{7} = 134$$

Number of Valid Ballots: 934.

Names of Candidates	First Choices	Transfer of Surplus Ballots of No. 1	Results	Transfer of Ballots of No. 13 defeated	Results	Transfer of Ballots of No. 9 defeated	Result	Transfer of Ballots of No. 10 defeated	Result	Transfer of Ballots of No. 4 defeated	Result	Transfer of Ballots of No. 12 defeated	Result	Transfer of Ballots of No. 8 defeated	Result
General															
1. Redington	237	–103	134	0	134	0	134	0	134	—	134	—	134	—	134
Western															
2. Guthrie	113	15	128	1	129	5	134	0	134	—	134	—	134	—	134
3. Show	104	22	126	5	131	0	131	3	134	—	134	—	134	—	134
4.	36	8	44	1	45	3	48	2	50	–50	0	—	—	—	—
Eastern															
5. Hosmer	105	15	120	2	122	1	123	7	130	4	134	—	134	—	134
6. Tillotson	56	13	69	1	70	6	76	2	78	11	89	16	105	29	134
Canadian															
7. Howe	63	5	68	1	69	1	70	5	75	7	82	15	97	37	134
Southern															
8.	46	7	53	1	54	5	59	11	70	7	77	16	93	–93	0
9.	25	2	27	1	28	–28	0	—	—	—	—	—	—	—	—
10.	34	4	38	1	39	4	43	–43	0	—	—	—	—	—	—
Mid-Western															
11.	52	6	58	1	59	3	62	5	67	13	80	19	99	24	123
12.	46	4	50	4	54	0	54	8	62	5	67	–67	0	—	—
13.	17	2	19	–19	0	—	—	—	—	—	—	—	—	—	—
Ineffective Ballots	0	—	—	—	—	—	—	—	—	3	3	1	4	3	7
Total Valid Ballots	934	0	934	0	934	0	934	0	934	0	934	0	934	0	934

of this first transfer, candidate No. 13 in the midwest group is seen to be the low man with but 19 votes. He was, therefore, the first to be declared defeated and his ballots were then transferred each to the second choice candidate marked theron, except that in any case where Redington was shown as the second choice candidate the ballot was given to the third choice candidate, since Redington was already elected and did not need it.

It will be noticed in Table 2 that of the 17 first-choice ballots marked for this defeated candidate (No. 13) 7 originated in one or the other of the 3 midwest sections. However, the other two midwest candidates got but

TABLE 2.

DISTRIBUTION OF THE BALLOTS CAST BY THE SEVERAL REGIONAL GROUPS OF VOTING MEMBERS IN THE 1929 ELECTION FOR MEMBERSHIP ON THE COUNCIL OF THE SOCIETY ACCORDING TO THE "FIRST CHOICES" INDICATED THEREON.

	Regional Origin of the ballots						
Candidates by regional groups	Eastern	Western	Southern	Mid western	Canadian	Others	Total
	Number of Ballots						
General							
1. Redington	95	78	21	35	4	4	237
Western							
2. Guthrie	25	73	7	6	0	2	113
3. Show	20	67	6	9	1	1	104
4.	10	21	4	1	0	0	36
		161					
Eastern							
5. Hosmer	62	20	11	8	4	0	105
6. Tillotson	46	5	1	4	0	0	56
	108						
Canadian							
7. Howe	32	8	4	5	14	0	63
					14		
Southern							
8.	18	3	22	1	1	1	46
9.	5	4	13	3	0	0	25
10.	8	14	7	4	1	0	34
			42				
Mid-Western							
11.	9	20	6	15	2	0	52
12.	19	13	8	5	1	0	46
13.	4	5	1	7	0	0	17
				27			
Total:	353	331	111	103	28	8	934

5 of them. Had these 7 midwest voters been especially interested in having some one of the three midwest candidates elected, all ballots would have been so marked, both for second and third choices as well. Again it will be noticed that 5 of the first choice votes for defeated candidate No. 13 originated in one of the western sections and apparently all 5 went back to the West when they came to be transferred. Of the 4 eastern votes that went to this same No. 13 candidate on first choice 3 returned to the credit of eastern candidates on the second choice.

The result of the second transfer shows candidate No. 9 in the southern group to be low man and the next to be declared defeated. Accordingly his 25 first choice and 3 second and other choice ballots were distributed to the remaining continuing candidates. Here again no very strong manifestation of sectional solidarity is apparent. For although 13 of this candidate's first choice votes originated in one of the sections in the southern group, only 8 of them were marked for the other two southern candidates as second choice.

Guthrie by this third transfer got enough second and other choice votes added to his firsts to give him his quota and election to the Council.

The results of this third transfer left another southern candidate as low man, No. 10, who was accordingly declared defeated. This released his 34 first choice and 9 second and other choice ballots for transfer to the other 8 candidates still in the running. Apparently, the 7 first choice votes which this candidate got from southern sections and the 4 second choice that came to him by the defeat of candidate No. 10, also a southern man, all went to the remaining southern candidate, No. 8, since he received 11 additional votes as a result of this transfer.

Show, as a result of this transfer, got the balance of his quota and was declared the third man elected to the Council, while Hosmer came within 4 of making his quota.

This fourth transfer left the third western candidate, No. 4, the low man and his defeat and transfer of ballots gave Hosmer his quota and election as the fourth successful candidate. Of the remaining continuing candidates No. 11 in the midwestern group profited most by this transfer.

It should be noticed, as a result of this fifth transfer, that three of the ballots became ineffective. In other words, the voters who marked these three ballots failed to express a choice for any one of the remaining candidates, namely, Nos. 6, 7, 8, 11 or 12. Accordingly, the three ballots had to be rejected. It is always desirable to indicate choices well in excess of the number of positions to be filled. This allows for the election or defeat of some of the candidates marked for the higher choices prior to the time that a voter's ballot is released for transfer.

The defeat of candidate No. 12, a midwestern man, next followed but resulted in only a slight advantage to the remaining midwesterner, No. 11. This sixth transfer left No. 8, the last of the southern group of candidates, as the low man. His defeat and ballot

transfers gave the election to Howe fifth and Tillotson sixth.

With the Council election thus completed, the midwestern man, No. 11, was left as a runner-up with 123 votes, the remaining 7 being ineffective. It is interesting to note, however, that even if these latter had been effective and transferable to No. 11, they would still have left him 4 short of the necessary quota for election.

In the main, therefore, 804 ballots altogether out of the 934 or 86.1 per cent, were effective in helping to elect one of the 6 successful Council candidates. Furthermore, 678, or 72.8 per cent of the voters saw the candidates of their first choice elected, while a goodly number of the others saw candidates of their second or third choice succeed.

On the question of sectional or even regional representation, it may not be inappropriate for each member to ask himself what conclusion, if any, are justified as to the attitude of the majority of the Society as represented by the voters in this election. Offhand probably 8 out of every 10 members if they were asked to vote on the question, in the abstract, would vote for sectional representation. On the other hand, the very same members when confronted by a concrete list of candidates would doubtless in most cases do as the voters in this election did, namely, pick and choose the best men so far as they knew them, and regardless of their location, perhaps falling back on sectionalism as a basis of choice where other criteria were lacking. In many if not most cases, of course, the voter will be most likely to know the men in his own section or region better than those elsewhere. He will thus unconsciously tend to vote sectionally or regionally, while nevertheless giving expression to his preference primarily as to men.

It is evident from the results of this first election that without sewing things up hard and fast on a sectional or regional basis our present method of elections *at large* by P. R. makes it possible for the members themselves, if they want it, to attain an end approaching as near sectional representation as the small Council organization will permit, namely, a regional representation with the individual sections grouped somewhat as indicated in Footnote 2. On the other hand, if any like-minded group of members want to depart from a sectional basis for any reason and thereby to honor a man, and likewise the Society, by election to the Council, one whose sectional backing is wholly inadequate, that can readily be done. A conspicuous example of this sort of voting was shown in the election of Dr. Howe. Of his 63 first choice votes half came from the four northeastern sections, whereas but half of the votes of the Canadian contingent were marked for him as first choice, while second and third choice ballots came to him from various sources to complete his quota. This is quite as it should be. Those members who prefer to have the Society served by the best men regardless of where they live should have an equal right with the Sectionalists to vote accordingly. This was the conviction of most if not all of the committee and the Council members who approved the adoption of P. R. elections at large for the new constitution.

THE ELECTION OF PRESIDENT AND VICE-PRESIDENT

Having completed the ballot count for the Council election, all of the 934 valid ballots were again sorted on the basis of first choice except for the 256 which had been marked for the seven candidates defeated in the Council election. These latter ballots were distributed, instead, to the second or next highest choice marked on each to the six successful Council candidates who continued as candidates in the presidential election. This distribution resulted as follows:

Redington	310
Guthrie	160
Show	147
Hosmer	142
Howe	91
Tillotson	84
	934

The quota for this election was necessarily increased to a majority, or 468 votes. Since none of the candidates had attained such a number at this juncture the ballot-count proceeded as above described for the council election. Thus Tillotson, Howe and Show were successively declared defeated before Redington could accumulate the necessary quota for election to the Presidency. This left Guthrie with 256 votes to his credit, while Hosmer had but 206, the remaining 4 having become ineffective. The Vice-Presidency, accordingly, went to Guthrie as runner-up without the formality of transferring Hosmer's ballots.

The results above indicated do not signify that Redington got the election by a bare majority of one. Undoubtedly, the votes in Hosmer's group would have shown a proportional number marked for him in preference to Guthrie, since on the first choice votes in the Council race the one outranked the other about 2 to 1 and that ratio was maintained in both the first tabulation in the presidential count (as shown above) and approximately so in the final count. However, in the transfer of the Show ballots, since none were given to Redington after he attained his quota, all the remainder were divided between Guthrie and Hosmer, with more going to Guthrie than Hosmer. Thus, Guthrie appeared in the final count to have pulled up on Redington, but instead at the end he was merely increasing his lead over Hosmer. The Hare System of P. R. is, accordingly, seen to be eminently fair as a means both of selecting a President and Vice-President and four other members of the Council, although the voter marks but one ballot to serve for both elections.

L. S. MURPHY,
U. S. Forest Service.

GISBORNE DISCUSSES OBJECTIVES OF FOREST FIRE RESEARCH

In order to portray his view of the entire fire problem and the place of research in helping to solve it, Gisborne, at the Section's meeting on February 16th, distributed an outline entitled, "The Scheme of Forest Fire Control," a copy of which is included here. The speaker then pointed out the basic importance of accurate knowledge con-

cerning fire damage and listed damage studies as a line of investigation most urgently needed.

In describing this need, Gisborne reported the results of the Regional Foresters' Conference in Washington a year ago when the various timber types of the whole country were rated according to their relative need of protection from fire. According to this rating, using one acre of the white pine type as a base, the relative areas of burn giving a uniform amount of damage are as follows for R-1 timber types: White pine, 1.0; spruce, 1.0; yellow pine, 2.0; larch-fir, 2.5; Douglas fir, 3.0; lodgepole (east of Divide), 6.0; (west of Divide), 10.0; noncommercial forest, 12.0; brush, grass, and sagebrush, 25.0 acres. The need is obvious of complete and accurate data on damage as a basis for checking the accuracy of these relative values.

It was brought out in the discussion of this phase of research work that the factors considered in deciding upon the above values were: (1) Timber value, present or potential. (2) Destruction

TABLE 1.

THE SCHEME OF FOREST FIRE CONTROL

Factors	Problems	For solution by experienced common sense, opinion, study, investigation, research.	Administrative action
1. Destructible Resources. Standing timber and reproduction Forage Soil productivity Water control Scenery and recreation Wild life	Permissible loss. A problem of economics and technical forestry, rather than in administrative fire control. Basic to the problems listed below	Measuring the physical losses and determining their values.	Determination of degree of protection to be given by timber types and areas.
			Education, legislation, control of use of fire.
		Influencing the public	Slash, snag, and debris disposal, fire breaks, better utilization.
	Prevention		Silvicultural control of species and shade.
2. Causes Man Lightning		Reducing inflammability	Number and distribution of men. (Their daily use).
	Presuppression		Lookout stations, ground and air patrols.
		Speed and strength of attack	Roads, trails, landing fields.
3. Hazard Fuel types Climate and weather Accessibility Topography			Equipment, Telephones, trucks, pack stock, pumps, tractors, plows, other tools, standardized cargoes.
	Suppression	Methods of suppression	Tactics of suppression. (Where to build line to check fire. How to build line to control fire. What to do along the line to put fire out).

of site value by fire. (3) The difficulty of re-establishment of the forest following fires. (4) Creation of future fire hazards which will prevent the maintenance of the forest itself.

It was also suggested by both Dean Spaulding and Mr. Shoemaker that before these ratings can be determined finally, it may be desirable to consider several other factors which affect the rating of damage in different timber types.

It was also brought out by F. J. Jefferson and Dean Spaulding that damage valuation differs between private and federal ownership. Some of the resources listed under Factor No. 1 on Gisborne's "Scheme of Fire Control" were well worth consideration by the government but did not have any present value to the private owner. Mr. Jefferson stressed especially the need of research in economics and fire to bridge this gap between the two classes of forest owners.

Gisborne listed as a project of importance second to Damage Studies, the work now under way to determine the Hour Control necessary if protection practices are to succeed in holding the losses within the limits permitted by the rating previously given. The total of 13,400 fire reports dating from 1921 to 1930 are now in the process of compilation for all national forests of the region. Twenty assistant forest supervisors and rangers of north Idaho and western Montana forests are coding the data preparatory to placing it on punch cards for the Hollerith machines.

The third line of research work recommended was a continuation and expansion of effort to measure fire danger and to provide a uniform method of rating prevailing and probable forest fire danger by timber types, by forests, and by regions. Gisborne gave examples of the lack of uniformity in determining what conditions warrant the employment of emergency guards, and the need of measurements so that the character of one fire season can be compared with another both on individual forests or for the region as a whole.

Additional research work recommended included: Better weather forecasts; more information on lightning; fire prevention work along the lines followed by the large fire insurance companies; an organized effort to improve all forms of fire control equipment including systematic tests of pumps, plows, tractors, etc.; and a Board of Fire Tactics to study, improve, and especially to standardize fire fighting practices, at least by reducing the variations now existing.

Of the eight lines of fire research advocated by Gisborne, five are now or will be under way after July 1 this year, if the $15,000 increase for fire research is appropriated by Congress. Of the other three lines of research, public relations is, of course, contributing to fire prevention, while Beatty's work on radio communication can be classed as well financed research on fire control equipment. Very little has been done on suppression tactics, however, beyond some incidental experiments by Flint with Cordeau-Bickford, and one series of tests of chemicals by the experiment station.

The scheme of fire control is given in Table 1.

J. C. Urquhart,
Reporter for
Northern Rocky Mountain Section.

PERSONALS

Dr. John Elton Lodewick has been appointed as chief of the section of forest products at the Pacific Northwest Forest Experiment Station.

Dr. Lodewick is a graduate of the New York State College of Forestry with the three degrees of B. S., M. S., and Ph. D., and has been a teacher of wood technology and research worker at Syracuse, University of Maine, and Virginia Polytechnic Institute, where he has been engaged upon research in lumber industry studies.

Dr. Lodewick succeeds W. H. Gibbons, who for many years was chief of this section and recently transferred to the Washington, D. C., office of the Forest Service.

E. A. Ziegler leaves the Southern Forest Experiment Station at New Orleans to assume the directorship of the Pennsylvania Forest Research Institute at Mont Alto.

Paul M. Dunn goes to the Utah State College of Agriculture as a professor in forestry and as extension forester for Utah. He was formerly a district forester in the Missouri State Forest Service.

D. B. Demeritt leaves the Department of Forestry, State College, Pennsylvania, to succeed D. S. Jeffers as Professor of Forestry at Iowa State College.

Section Count of the Society of American Foresters as of July 15, 1931

Section	Fellow	Senior	Junior	Asso.	Hon.	Corres.	Total
Allegheny	1	78	105		1		185
Appalachian		27	42	2			71
California		61	101	11			173
Central Rocky Mountain		32	62	1			95
Gulf States		15	35	3			53
Intermountain		20	45				65
Minnesota	1	28	40				69
New England	4	93	122	9			228
New York		54	107	6	1		168
Northern Rocky Mountain		53	69	1			123
North Pacific	1	72	117	1			191
Ohio Valley		36	55	2			93
Ozark		8	17				25
Southeastern		13	33	1			47
Southwestern		16	24	1			41
Washington	5	70	25	10	2		112
Wisconsin		32	19	1			52
Total	12	708	1018	49	4		1791
Foreign		10	18	1	9	8	46
Grand Total	12	718	1036	50	13	8	1837

Elections to Membership

The following men have been elected to the grade of membership indicated.

ALLEGHENY SECTION

Junior Membership

Brown, William E.
Burris, Michael M.
Eyman, Wm. G.
Hottenstein, Wesley L.
Klein, C. Cyril
Lloyd Hugh C.
Smith, Ralph W.
Watson, Carl H.

APPALACHIAN SECTION

Junior Membership

Byrd, Zeke B.
Easley, L. T.
Wogensen, Adolph

CALIFORNIA SECTION

Junior Membership

Lloyd, Leslie D.
Longacre, A. M.
Miller, George
Read, Wayne B.
Robinson, Frank A.
Sabine, H. Gray
Salman, Kenneth A.

Senior Membership

Barrett, L. A.

CENTRAL ROCKY MOUNTAIN SECTION

Junior Membership

Burton, C. Leslie
Cummings, Lewis A.
Klemme, Marvin
Loring, J. Malcom
Martin, Hugh E.
Roberts, Floyd Thomas

GULF STATES SECTION

Junior Membership

Cowan, William Foster
Ellis, Wilfred E.
McKellar, A. Donald
Whittemore, James A.

INTERMOUNTAIN SECTION

Junior Membership

Balch, A. P.
Christensen, Ivan
Connaughton, Charles A.
Pearson, Thomas V.
Pickett, Ray
Powers, F. E.
Price, Curtis E.
Price, H. H.
Riddle, Wallace M.
Shank, Henry Mercer
Varner, Irvin M.

Senior Membership

Benedict, Miller S.
Mattsson, C. A.
Miles, Clark
Renner, F. G.

NEW ENGLAND SECTION

Junior Membership

Averill, Clarence C.
Farley, Philip E.
Frost, Levi M.
Hinkley, Frank R.
Mullin, George B. P.
Peabody, Joseph L.

Senior Membership

Hosley, N .W.
Stephens, Raymond D.

NEW YORK SECTION

Junior Membership

Carlson, Floyd E.
Dence,Wilford A.
Eliason, Everett J.
Handy, Ernest L.
Holcomb, Harry W.
Kingsbury, Corydon D.
Lewis, Ernest F.
Marco, Herbert F.
Minckler, Leon S.
Schwarz, G. Victor

NORTHERN ROCKY MOUNTAIN SECTION

Junior Membership

Barron, J. S.
Davis, Kenneth P.
DeLeon, Donald
Eddy, Leslie E.
Guernsey, Wm. G.
Harris, Thos. H.
Hillman, W. P.
Jost, Edwin J.
Krueger, Otto C. F.
Leavitt, Roswell
Merrill, Lee Potter
Miller, Douglas R.
Otter, Floyd
Redding, Hugh S.
Rudolph, Rosser A.
Swan, Kenneth D.
Tennant, R. E.

Senior Membership

Cobb, Francis E.
Segersten, A. A.

NORTH PACIFIC SECTION

Junior Membership

Iler, James C.

OHIO VALLEY SECTION

Junior Membership

Linn, Edward R.

OZARK SECTION

Junior Membership

Anderson, A. H.
Beck, Don W.
Dale, Wm. P.
Fathman, A. Stewart
Melichar. Charles
Ripper, E. E.
Stoller, Karl M.
Wait, James M.

Senior Membership

Hartman, Arthur W.

SOUTHWESTERN SECTION

Senior Membership

Adams, John A.

WASHINGTON SECTION

Junior Membership

Bennett, Carey H.
Chittick, George D.
Hedden, Geo. W.
Krummes, Wm. T.

WISCONSIN SECTION

Junior Membership

Buenger, Clarence C.
Kouba, Theodore F.

HAVE YOU RECENTLY CHANGED YOUR ADDRESS?

Have you *notified us* so that your copy of the JOURNAL OF FORESTRY will reach you? Magazines are not always forwarded by the Post Office when a change of address is made.

Make sure that *we have your correct address* and insure prompt delivery of the JOURNAL. All changes should be sent to

JOURNAL OF FORESTRY
Suite 810, Hill Bldg., 839 17th St., N. W.
WASHINGTON, D. C.

FORTHCOMING EVENTS

11th Annual Meeting
Association of State Foresters
November 16-18, 1931
Southern Georgia and Northern Florida

18th Annual Meeting
American Game Conference
December 1-2, 1931
New York City

2nd Annual Meeting
Central States Forestry Congress
December 3-5, 1931
Cincinnati, Ohio

31st Annual Meeting
Society of American Foresters
December 29-31, 1931
New Orleans, La.

Drainage, Conservation & Flood Control Congress
February 17-19, 1932
Louisville, Ky.

5th Pacific Science Congress
May 23-June 4, 1932
Victoria and Vancouver, Canada

SECTION MEETINGS

Society of American Foresters

Washington Section
November 12, 1931
Washington, D. C.

California Section
November 20, 1931
Berkeley, Calif.

Section secretaries are welcome to use this box for announcing their meetings. Copy should be in the hands of the Editor or Executive Secretary one month before date of publication.

SOCIETY OFFICERS

Officers and Members of Council

President, Paul G. Redington, Biological Survey, Washington, D. C.
Vice-President, John D. Guthrie, Forest Service, Portland, Oregon.
Secretary-Treasurer, E. Morgan Pryse, Office of Indian Affairs, Washington, D. C.

Council

The Council consists of the above officers and the following members:

	Term expires		Term expires
R. Y. Stuart	Dec. 31, 1931	Clifton D. Howe	Dec. 31, 1933
Aldo Leopold	Dec. 31, 1931	Stuart B. Show	Dec. 31, 1933
T. T. Munger	Dec. 31, 1931	Ralph S. Hosmer	Dec. 31, 1933
W. G. Howard	Dec. 31, 1931	Claude R. Tillotson	Dec. 31, 1933

Member in Charge of Admissions

W. G. Howard

Executive Officers

F. W. Reed, *Executive Secretary* L. Audrey Warren, *Business Manager*
810 Hill Bldg., Washington, D. C.

Editor, Journal of Forestry

Emanuel Fritz, 231 Giannini Hall, Berkeley, Calif.

Section Officers

Allegheny

R. D. Forbes, Chairman, Allegheny Forest Exp. Sta., 3437 Woodland Ave., Philadelphia, Pa.
H. S. Newins, Vice-Chairman, State House, Charleston, W. Va.
H. F. Round, Secretary, Forester's Office, Pa. R. R. Co., Philadelphia, Pa.

Appalachian

Verne Rhoades, Chairman, P. O. Box 1346, Asheville, N. C.
C. F. Evans, Vice-Chairman, 223 Federal Bldg., Asheville, N. C.
W. K. Beichler, Secretary, 222 Federal Bldg., Asheville, N. C.

California

William G. Durbin, Chairman, U. S. Forest Service, Susanville, Calif.
Myron E. Krueger, Vice-Chairman, 231 Giannini Hall, Berkeley, Calif.
Hubert L. Person, Secretary, 332 Giannini Hall, Berkeley, Calif.

Central Rocky Mountain

Allen S. Peck, Chairman, U. S. Forest Service, Denver, Colo.
John W. Spencer, Vice-Chairman, U. S. Forest Service, Denver, Colo.
J. A. Donery, Secretary, U. S. Forest Service, Denver, Colo.

Gulf States

E. A. Ziegler, Chairman, Southern Forest Experiment Sta., New Orleans, La.
Fred B. Merrill, Vice-Chairman, State Forester, Jackson, Miss.
A. R. Spillers, Secretary, U. S. Forest Service, New Orleans, La.

Intermountain

Earl C. Sanford, Chairman, U. S. Forest Service, Ogden, Utah.
T. G. Taylor, Vice-Chairman, U. S. Forest Service, Logan, Utah.
G. W. Craddock, Jr., Acting Secretary, U. S. Forest Service, Ogden, Utah.

Minnesota

R. N. Cunningham, Chairman, Lake States Forest Exp. Sta., University Farm, St. Paul, Minn.
Raymond E. Stevens, Secretary-Treasurer, Minn. Land Economic Survey, University Farm, St. Paul, Minn.

New England

Austin F. Hawes, Chairman, State Forester, Hartford, Conn.
H. J. MacAloney, Secretary, Northeastern Forest Exp. Sta., Amherst, Mass.

New York

Arthur S. Hopkins, Chairman, Conservation Dept., Albany, N. Y.
H. C. Belyea, Secretary, College of Forestry, Syracuse, N. Y.

Northern Rocky Mountain

D. S. Olson, Chairman, U. S. Forest Service, Missoula, Mont.
C. K. McHarg, Vice-Chairman, U. S. Forest Service, Coeur d'Alene, Idaho.
I. T. Haig, Secretary, N. Rocky Mt. Forest Exp. Sta., Missoula, Mont.

North Pacific

L. F. Cronemiller, Chairman, State House, Salem, Ore.
R. E. McArdle, Secretary-Treasurer, 514 Lewis Bldg., Portland, Ore.

Ohio Valley

E. M. Bruner, Chairman, 516 Federal Bldg., Louisville, Ky.
T. W. McKinley, Secretary-Treasurer, Isaac Bernheim Estate, Shepherdsville, Ky.

Ozark

George R. Phillips, Chairman, Oklahoma Forest Service, Oklahoma City, Okla.
A. C. Shaw, Vice-Chairman, U. S. Forest Service, Hot Springs, Ark.
Charles A. Gillett, Secretary, Extension Service, Little Rock, Ark.

Southeastern

S. J. Hall, Chairman, 1412 Barnett Natl. Bank Bldg., Jacksonville, Fla.
E. W. Hadley, Vice-Chairman, Lake City, Fla.
W. H. Moore, Secretary-Treasurer, c/o James D. Lacey Co., Jacksonville, Fla.

Southwestern

Quincy Randles, Chairman, Forest Service, Albuquerque, N. Mex.
D. A. Shoemaker, Vice-Chairman, U. S. Forest Service, Albuquerque, N. Mex.
Stanley F. Wilson, Secretary, U. S. Forest Service, Albuquerque, N. Mex.

Washington

H. A. Smith, Chairman, U. S. Forest Service, Washington, D. C.
C. Stowell Smith, Vice-Chairman, Natl. Lumber Mfrs. Assoc., Transportation Bldg., Washington, D. C.
Alfred E. Fivaz, Secretary, Bureau Plant Industry, Washington, D. C.

Wisconsin

C. J. Telford, Chairman, Forest Products Laboratory, Madison, Wis.
M. Y. Pillow, Secretary, Forest Products Laboratory, Madison, Wis.

YOUR ATTENDANCE AT THE ANNUAL MEETING WILL PAY DIVIDENDS IN IDEAS AND VALUABLE CONTACTS

Make Your Plans Now to Attend the Annual Meeting of the Society December 29-31, 1931, New Orleans, La.

Two days will be given over to the presentation of papers followed by a day's field trip to observe the forestry work of the Great Southern Lumber Company. The banquet and dance, to which the ladies are invited, will be at the Jung Hotel, December 30, 1931.

Special railroad rates of a fare and a half for round trip tickets are assured for all who reigster at the headquarters of the American Association for the Advancement of Science.

The tentative program of the Annual Meeting provides for papers on Forestry in the South; Uses of Aerial Photographs in Forest Mapping (illustrated); Work of the Forest Survey; Wisconsin Land Survey; Our National Erosion Problem; National Timber Conservation Board; The Hardwood Industry; Rôle of Forest Products in Railroad Revenue; National Aspects of Coöperative Fire Prevention; Land Use Problem of the South, etc.

If you plan to attend, please notify NOW the Chairman of the Committee, G. H. Lentz, Southern Forest Experiment Station, 348 Baronne St., New Orleans, Louisiana.

Entertainment Will Be Provided For the Ladies.